OPERATING INSTRUCTIONS

# deTec4

## Safety light curtain

SICK
Sensor Intelligence.

### Described product

deTec4

### Manufacturer

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### Legal information



### Original document

This document is an original document of SICK AG.

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# 1 About this document

## 1.1 Purpose of this document

These operating instructions contain information required during the life cycle of the safety light curtain.

These operating instructions are available to all those who work with the safety light curtain.

Please read these operating instructions carefully and make sure that you understand the content fully before working with the safety light curtain.

## 1.2 Scope

**This document applies to the following products:**

- Product code: deTec4
- “Operating instructions” type label entry: 8021643

### Document identification

**Document part number:**

- This document: 8021645
- Available language versions of this document: 8021643

You can find the current version of all documents at www.sick.com.

## 1.3 Target groups of these operating instructions

Some chapters of these operating instructions are intended for certain target groups. However, the entire operating instructions are relevant for intended use of the product.

*Table 1: Target groups and selected chapters of these operating instructions*

| Target group | Chapters of these operating instructions |
|---|---|
| Project developers (planners, developers, designers) | "Project planning", page 26<br>"Configuration", page 91<br>"Technical data", page 140<br>"Accessories", page 153 |
| Installers | "Mounting", page 76 |
| Electricians | "Electrical installation", page 86 |
| Safety experts (such as CE authorized representatives, compliance officers, people who test and approve the application) | "Project planning", page 26<br>"Configuration", page 91<br>"Commissioning", page 109<br>"Technical data", page 140<br>"Checklist for initial commissioning and commissioning", page 167 |
| Operators | "Operation", page 116<br>"Troubleshooting", page 124 |
| Maintenance personnel | "Maintenance", page 122<br>"Troubleshooting", page 124 |

## 1.4 Additional information

www.sick.com

The following information is available on the Internet:

- Data sheets and application examples
- CAD data and dimensional drawings

- Certificates (e.g. EU declaration of conformity)
- Guide for Safe Machinery Six steps to a safe machine

## 1.5 Symbols and document conventions

The following symbols and conventions are used in this document:

### Safety notes and other notes

**DANGER**
Indicates a situation presenting imminent danger, which will lead to death or serious injuries if not prevented.

**WARNING**
Indicates a situation presenting possible danger, which may lead to death or serious injuries if not prevented.

**CAUTION**
Indicates a situation presenting possible danger, which may lead to moderate or minor injuries if not prevented.

**NOTICE**
Indicates a situation presenting possible danger, which may lead to property damage if not prevented.

**NOTE**
Indicates useful tips and recommendations.

### Instructions to action

► The arrow denotes instructions to action.

1. The sequence of instructions for action is numbered.
2. Follow the order in which the numbered instructions are given.

✓ The check mark denotes the result of an instruction.

### LED symbols

These symbols indicate the status of an LED:

○ The LED is off.
◉ The LED is flashing.
● The LED is illuminated continuously.

### Sender and receiver

These symbols indicate the sender and receiver of the device:

The symbol indicates the sender.
The symbol indicates the receiver.

# 2 Safety information

## 2.1 General safety notes

**DANGER**
The product can not offer the expected protection if it is integrated incorrectly.

- ► Plan the integration of the product in accordance with the machine requirements (project planning).
- ► Implement the integration of the product in accordance with the project planning.

**DANGER**
Death or severe injury due to electrical voltage and/or an unexpected startup of the machine

- ► Make sure that the machine is (and remains) disconnected from the voltage supply during mounting and electrical installation.
- ► Make sure that the dangerous state of the machine is and remains switched off.

**DANGER**
Improper work on the product

A modified product may not offer the expected protection if it is integrated incorrectly.

- ► Apart from the procedures described in this document, do not repair, open, manipulate or otherwise modify the product.

**CAUTION**
Laser class 1

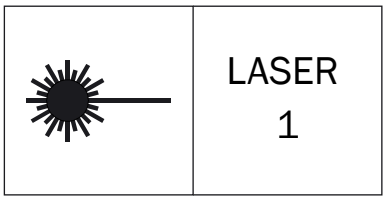



*Figure 1: Laser class 1*

This device has been classified in accordance with the following standards:

- IEC 60825-1:2007/EN 60825-1:2007
- IEC 60825-1:2014/EN 60825-1:2014
- 21 CFR 1040.10 and 1040.11, except for deviations pursuant to Laser Notice No. 50 dated 2007-06-24

The laser is eye-safe. Looking directly into the laser may cause temporary impairments.

The outlet opening of the laser radiation is located in the sender, see figure 5, page 21. The laser is only active when the laser alignment aid is switched on.

Laser identification is located on the rear of the sender.

- ► Comply with the latest version of the applicable provisions on laser protection.

**CAUTION**
If any operating or adjusting devices other than those specified in this document are used or other methods are employed, this can lead to dangerous exposure to radiation.

- ► Only use the operating or adjusting devices specified in this document.
- ► Only follow the methods specified in this document.
- ► Do not open the housing, except for the purposes of the installation and maintenance work specified in these operating instructions.

## 2.2 Correct use

The deTec4 safety light curtain is an electro-sensitive protective device (ESPE) and is suitable for the following applications:

- Hazardous point protection
- Access protection
- Hazardous area protection

The product may be used in safety functions.

The deTec4 safety light curtain must only be used within the limits of the prescribed and specified technical data and operating conditions at all times.

Any instance of improper use, incorrect modification, or manipulation of the deTec4 safety light curtain shall void any warranty provided by SICK AG; furthermore, SICK AG shall not accept any responsibility or liability for any resulting damage and consequential damage.

## 2.3 Inappropriate use

The safety light curtain works as an indirect protective measure and cannot provide protection from parts thrown out nor from emitted radiation. Transparent objects are not detected.

**Among others, the deTec4 safety light curtain is not suitable for the following applications:**

- Outdoors
- Underwater
- In explosion-hazardous areas
- At altitudes over 3,000 m above sea level
- In environments with increased levels of ionizing radiation

## 2.4 Requirements for the qualification of personnel

The safety light curtain must only be configured, installed, connected, commissioned and serviced by qualified safety personnel.

### Project planning

You need safety expertise to implement safety functions and select suitable products for that purpose. You need expert knowledge of the applicable standards and regulations.

### Mounting, electrical installation and commissioning

You need suitable expertise and experience. You must be able to assess if the machine is operating safely.

### Configuration

You need suitable expertise and experience. You must be able to assess if the machine is operating safely.

### Operation and maintenance

You need suitable expertise and experience. You must be instructed in machine operation by the machine operator. For maintenance, you must be able to assess if the machine is operating safely.

# 3 Product description

## 3.1 Structure and function

### Overview

The deTec4 safety light curtain is an electro-sensitive protective device (ESPE) consisting of a sender and receiver.

A series of parallel infrared light beams forms a protective field between sender and receiver that protects the hazardous area (hazardous point, access, and hazardous area protection). When one or more beams are completely interrupted, the safety light curtain reports the interruption in the light path to the secure output signal switching devices (OSSDs) by a signal change. The machine or its control must safely analyze the signals (for example using a safe control or safety relays) and stop the dangerous state.

Sender and receiver automatically synchronize themselves optically. An electrical connection between both components is not required, but is advantageous.

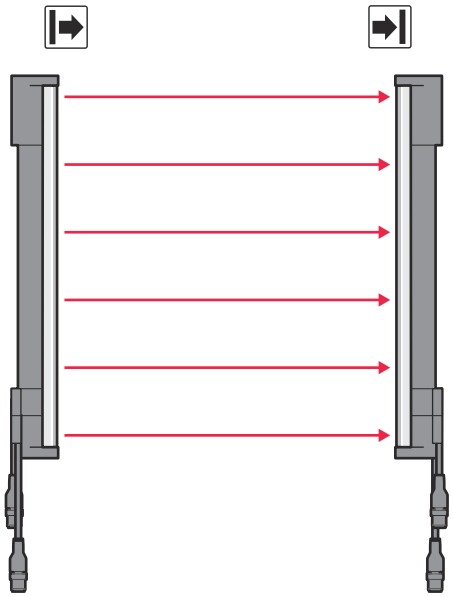


*Figure 2: Sender and receiver*

### Protective field height

The protective field height indicates the range within which the test rod belonging to the safety light curtain is reliably detected.

### Protective field width

The protective field width is the dimension of the light path between sender and receiver. The maximum protective field width is limited by the scanning range.

### Resolution

The resolution describes the size of the smallest object detected by the safety light curtain in the protective field. The resolution corresponds to the diameter of the test rod belonging to the safety light curtain.

The safety light curtain has a resolution of 14 mm. This resolution provides finger protection.

The safety light curtain has a resolution of 30 mm. This resolution provides hand protection.

**Scanning range**

The scanning range is the maximum protective field width.

The scanning range is reduced by using deflector mirrors.

The scanning range is reduced by using a weld spark guard.

**Further topics**

- "Flexible control cabinet cabling and status indication on both sides", page 20
- "Data sheet", page 140
- "Deflector mirrors", page 160
- "Weld spark guard", page 154

## 3.2 Product characteristics

### 3.2.1 Device overview

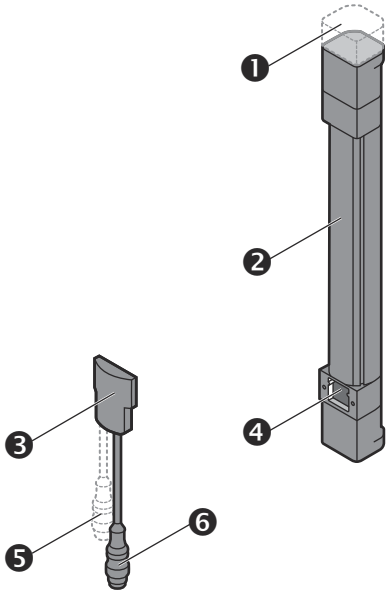



*Figure 3: Device overview*

❶ End cap with integrated indicator lamp (optionally available on the receiver)
❷ Sender or receiver
❸ System plug
❹ Terminal compartment
❺ Extension connection (only for certain system plugs)
❻ System connection

### 3.2.2 Absence of blind zones

The design and construction of the safety light curtain extends the protective function of a device to the end of the housing without any blind spots. The absence of blind zones reduces the space requirement when integrated in the machine.

Exception: If the end cap on the receiver contains an integrated LED, the protective function of the device only extends to below the LED.

### 3.2.3 Automatic calibration of the protective field width

When switched on, the safety light curtain automatically calibrates to the protective field width.

### 3.2.4 Dynamic protective field width

For a dynamic protective field width, a range is configured. Within this range, the protective field width may change during operation.

There are 3 dynamic protective field widths to choose from for each resolution of the safety light curtain.

*Table 2: Adjustable ranges for dynamic protective field widths*

| Resolution | Small range | | Medium range | | Large range | |
|---|---|---|---|---|---|---|
| | Minimum [1] | Typical [2] | Minimum [1] | Typical [2] | Minimum [1] | Typical [2] |
| 14 mm | 0.15 m ... 4 m | 0.15 m ... 5 m | 1 m ... 8 m | 1 m ... 10 m | 2 m ... 16 m | 2 m ... 20 m |
| 30 mm | 0 m ... 6 m | 0 m ... 7.5 m | 0 m ... 12 m | 0 m ... 15 m | 0 m ... 24 m | 0 m ... 30 m |

1) The minimum scanning range specifies a range in which a function is guaranteed to operate correctly and safely under industrial conditions. A sufficient level of signal reserve to ensure very high availability is included in the calculation.

2) The typical scanning range specifies a range in which the safety light curtain operates correctly and safely under industrial conditions. The level of signal reserve is enough to ensure high availability.

**Further topics**

- "Minimum distance to reflective surfaces", page 31

### 3.2.5 Beam coding.

Depending on its configuration, the safety light curtain operates with 1 of 3 beam codings: uncoded, code 1 or code 2. The beam coding “uncoded” allows for particularly short response times. In order to avoid mutual interference between 2 neighboring safety light curtains, one can be operated with code 1 and the other with code 2.

### 3.2.6 Reduced resolution

Using a reduced resolution, up to 2 adjacent beams can be interrupted without the OSSDs switching to the OFF state.

As a result, smaller objects can move into the detection area of the safety light curtain without the curtain reacting and the machine switching off. For this purpose, the permitted resolution is reduced by up to 2 beams.

The reduced resolution can be used for suppressing interference objects, if, for instance, cables or hoses need to be routed through the protective field. The function can be configured during commissioning.

### 3.2.7 Alignment aid

A laser alignment aid is installed in the sender of the safety light curtain. The laser alignment aid can be switched on to perform a simple alignment of the sender.

Diagnostic LEDs are installed in the receiver of the safety light curtain. For a simple alignment of the receiver, diagnostic LEDs 1, 2, 3 and 4 indicate the alignment quality once the safety light curtain has been switched on.

Diagnostic LEDs 5 and 6 light up if the topmost beam (far from system plug) is synchronized. Diagnostic LEDs 7 and 8 light up if the bottommost beam (near system plug) is synchronized.

### 3.2.8 Restart interlock

The safety light curtain has an integrated restart interlock. The function can be configured during commissioning.

A restart interlock prevents the machine from starting again once the protective device has been triggered. The operator must first press a reset pushbutton to allow the protective device to resume its monitoring function. The operator can then restart the machine.

The reset pushbutton can be connected locally to the extension connection or in the control cabinet.

### 3.2.9 External device monitoring (EDM)

The safety light curtain has integrated external device monitoring. The function can be configured during commissioning.

The external device monitoring (EDM) monitors the status of downstream contactors.

In order to use external device monitoring, positively guided contactors must be used to switch off the machine. If the auxiliary contacts of the positively guided contactors are connected to the external device monitoring, the external device monitoring checks whether the contactors switch correctly when the OSSDs are switched off.

### 3.2.10 Application diagnostic output

The safety light curtain has an application diagnostic output on the system connection and on the extension connection.

Depending on the configuration, the application diagnostic output signals a certain status of the safety light curtain, e.g. if the reset pushbutton must be engaged or if there is a weak signal at the receiver.

For a signal of the safety light curtain to be displayed, a light can be connected to the application diagnostic output or the signal can be transmitted to the machine controller.

**The following signals can be output over the application diagnostic output:**

- Reset required
- Weak signal
- Ignored object
- Muting status
- Override required
- Valid object for Smart Box Detection

### 3.2.11 Cascading

Cascading allows up to 3 safety light curtains to be connected in series, e.g. for reliable presence detection. The device connected to the control cabinet is the host device. The subsequent sensors are called guest 1 and guest 2.

### 3.2.12 Smart presence detection

#### Overview

The safety light curtain features smart presence detection for access and hazardous area protection. The function can be configured during commissioning.

#### Principle of operation

Smart presence detection is implemented using a cascade. The guest system is only active if the protective field of the host system has been interrupted. The OSSDs then change to the OFF status and the machine is stopped. As long as the protective field of the host or guest system is interrupted, machine start-up is not possible.

If all of the protective fields have been clear for at least 0.5 s, the OSSDs change back to the ON state and the guest system returns to sleep mode.

Smart presence detection prevents an unintentional machine shut-off, for example if chips fall into the hazardous area protected by the guest systems.

### 3.2.13 Muting

Muting temporarily bypasses the protective action of the safety light curtain so that material can be transported to or from a machine or system. As a result, the work process remains uninterrupted. The function can be configured during commissioning.

The distinction between people and materials is made by 2 signals that are independent of each other. Based on the logical evaluation of these signals, the protective device is bypassed if a valid muting condition is present. As soon as something other than material enters the hazardous area, the work process is interrupted.

### 3.2.14 Partial blanking

During partial blanking, only the topmost beam of the protective field remains active if a valid muting condition is present. All other beams are temporarily bypassed (e.g. for a certain object height). As soon as the topmost beam is interrupted, the OSSDs switch to the OFF status.

### 3.2.15 Smart Box Detection

Smart Box Detection enables human-material differentiation by conveying only geometrically uniform objects to or from a plant or machine.

The protective field always remains active, meaning interruption in the protective field above an object is reliably detected by the protective device and the dangerous machine state is stopped.

### 3.2.16 IO-Link

#### Overview

The safety light curtain can communicate with an IO-Link master via an IO-Link connector, which is available as an accessory.

**The following information can be output via IO-link:**

- Application diagnostic output status information
- Device information and device status
- Configuration of the device
- Status of each individual light beam
- Error history
- Reasons for the last lockout

**The following information can be controlled via IO-link:**

- LED signal behavior of the field indicator
- LED light behavior of the integrated indicator lamp on the receiver (optional)
- Switching on and off of the integrated laser alignment aid

#### Complementary information

The safety light curtain must be supplied with voltage to enable communication with an IO-Link master via the IO-Link connector.

#### Further topics

- "Accessories", page 153

### 3.2.17 Near Field Communication (NFC)

#### Overview

The receiver of the safety light curtain has an integrated NFC interface for transmitting diagnostic data of the protective device to an NFC-capable device.

The integrated NFC interface is intended for temporary use.

#### Diagnostic data

**The following diagnostic data can be displayed in an NFC-capable device:**

- Device-specific information of the protective device, e.g. name, serial number, type code
- Information on configuration, e.g. whether the restart interlock is activated
- Current status of the protective device, e.g. status of the OSSDs, quality of the alignment
- Error diagnostics with specification of the error code, error description, diagnostic LED and error correction

An NFC-capable antenna is integrated behind the front screen of the safety light curtain for transmitting the data. The area is marked with the NFC-symbol.

*Figure 4: NFC symbol* [1)]

To be able to call up information for diagnostics and configuration, you need an NFC-capable device, e.g. a smartphone and the app provided by SICK.

► Hold the NFC-capable mobile device near the marked NFC-area on the lower end of the receiver to call up the diagnostic data.

### 3.2.18 System plug

#### Overview

**The following system plugs are available for the safety light curtain:**

- SP1 system plug
- SP2 system plug

**The system plugs are available in the following versions:**

- System plug with 5-pin system connection
- System plug with 8-pin system connection
- System plug with 5-pin system connection and 5-pin extension connection
- System plug with 8-pin system connection and 5-pin extension connection

#### Functional scope

The system plugs differ in range of functions.

1) The N-Mark is a trademark or registered trademark of NFC Forum, Inc. in the United States and in other countries.

*Table 3: Range of functions*

| Functions | SP1 system plug | SP2 system plug |
|---|---|---|
| Beam coding | ✓ | ✓ |
| Restart interlock | ✓ | ✓ |
| External device monitoring (EDM) | ✓ | ✓ |
| Application diagnostic output | ✓ | ✓ |
| Cascade | ✓ | ✓ |
| IO-Link | ✓ | ✓ |
| Reduced resolution | – | ✓ |
| Dynamic protective field width | – | ✓ |
| Smart presence detection | – | ✓ |
| Muting | – | ✓ |
| Partial blanking | – | ✓ |
| Smart Box Detection | – | ✓ |

The SP1 system plug can be used on all of the senders and receivers of a single system or on a host–guest system.

The SP2 system plug is only used on the receiver of a host system or single system. The SP1 system plug is used on all other receivers of the guest systems and on all senders.

### Prerequisites

- The SP2 system plug can only be used with receivers that have the digit 1 at the following position of their type code:
  C4P-E*****1***

### Using the system plugs

*Table 4: Use of SP1 system plug in a single system*

| | SP1 system plug type code | | | |
|---|---|---|---|---|
| | 1000  | 1200  | 1100  | 1300  |
| Sender | ✓ | ✓ 1) | ✓ 2) | ✓ 1) 2) |
| Receiver | ✓<br>• Beam coding | ✓<br>• Beam coding<br>• Restart interlock<br>• External device monitoring<br>• Application diagnostic output | ✓<br>• Beam coding<br>• Restart interlock<br>• External device monitoring<br>• Application diagnostic output<br>• IO-Link | ✓<br>• Beam coding<br>• Restart interlock<br>• External device monitoring<br>• Application diagnostic output<br>• IO-Link |

✓ SP1 system plug suitable.

1) At the sender, the 8-pin system connection is solely for the purposes of providing standardized wiring. It is particularly recommended if the 8-pin system connection at the receiver is used and the sender and receiver are connected to each other via a T-connector.

2) If a sender does not have an additional guest connected to it, the extension connection has no function and must be sealed with a protective cap.

*Table 5: Use of SP2 system plug in a single system*

| | SP2 system plug type code | | | |
|---|---|---|---|---|
| | 2000  | 2200  | 2100  | 2300  |
| Sender | – | – | – | – |
| Receiver | ✓<br>• Beam coding<br>• Reduced resolution<br>• Dynamic protective field width<br>• Smart Box Detection | ✓<br>• Beam coding<br>• Reduced resolution<br>• Dynamic protective field width<br>• Restart interlock<br>• External device monitoring<br>• Application diagnostic output<br>• Smart Box Detection | ✓<br>• Beam coding<br>• Reduced resolution<br>• Dynamic protective field width<br>• Restart interlock<br>• External device monitoring<br>• Application diagnostic output<br>• IO-Link<br>• Muting<br>• Smart Box Detection | ✓<br>• Beam coding<br>• Reduced resolution<br>• Dynamic protective field width<br>• Restart interlock<br>• External device monitoring<br>• Application diagnostic output<br>• IO-Link<br>• Muting<br>• Smart Box Detection |

✓ SP2 system plug suitable.
– SP2 system plug not suitable. An SP1 system plug must be used at the sender of a single system.

*Table 6: Use of system plugs in a cascade*

| | | SP1 system plug type code | | | SP2 system plug type code | |
|---|---|---|---|---|---|---|
| | | 1000  | 1100  | 1300  | 2100  | 2300  |
| Host | Sender | – | ✓ | ✓ [1] | – | – |
| | Receiver | – | ✓<br>**Functions at the host**<br>• Beam coding | ✓<br>**Functions at the host**<br>• Beam coding<br>• Restart interlock<br>• External device monitoring<br>• Application diagnostic output | ✓<br>**Functions at the host**<br>• Beam coding<br>• Reduced resolution<br>• Dynamic protective field width<br>• Smart presence detection | ✓<br>**Functions at the host**<br>• Beam coding<br>• Reduced resolution<br>• Dynamic protective field width<br>• Restart interlock<br>• External device monitoring<br>• Application diagnostic output<br>• Smart presence detection |
| First guest (for cascade with 2 guest devices) | Sender | – | ✓ | – | – | – |
| | Receiver | – | ✓ | – | – | – |
| Last guest | Sender | ✓ | ✓ [2] | – | – | – |
| | Receiver | ✓ | ✓<br>**Functions at the last guest**<br>• External device monitoring<br>• Restart interlock<br>• Application diagnostic output<br>• IO-Link | – | – | – |

✓ System plug suitable.

– System plug not suitable. An SP1 system plug must be used on the receiver of a guest system as well as on the sender of a host system and guest system.

1) At the sender, the 8-pin system connection is solely for the purposes of providing standardized wiring. It is particularly recommended if the 8-pin system connection at the receiver is used and the sender and receiver are connected to each other via a T-connector.

2) If a sender does not have an additional guest connected to it, the extension connection has no function and must be sealed with a protective cap.

### 3.2.19 Flexible control cabinet cabling and status indication on both sides

**The safety light curtain can be connected to the control cabinet in different ways as required:**

- Separate connecting cables for sender and receiver
- Separate connecting cables for sender and receiver with connection in the control cabinet
- Connection of sender and receiver via a T-connector, shared 5-pin or 8-pin connecting cable to the control cabinet

In a cascade, only the host sender and host receiver are connected to the control cabinet.

**The OSSD status and the status of the protective field are indicated via LEDs on the sender and receiver when the following applies:**

- The sender and receiver are connected to one another in the control cabinet
- The sender and receiver are connected to one another via a T-connector

If the sender and receiver are not connected to each other, this status information is only indicated at the receiver.

In order to output status information to the sender via IO-Link, the sender and receiver must be connected with each other.

**Further topics**

- "Connection diagrams", page 65

### 3.2.20 Status indicators

**Overview**

The sender and receiver LEDs indicate the operational status of the safety light curtain.

**Sender displays**

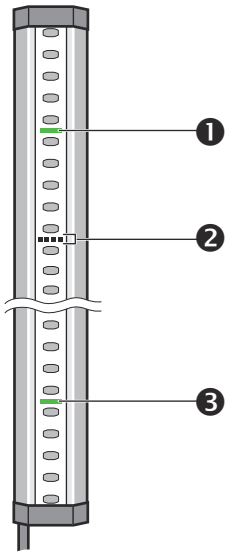



*Figure 5: Sender indicators*

The sender has one laser alignment aid and at least two light emitting diodes, which indicate the operational status:

| Position | LED color | Function | Labeling |
|---|---|---|---|
| ❶ | Red/yellow/green | Field indicator [1]; shows the status of the protective field and additional information about the status display | – |
| ❷ | – | Laser alignment aid | – |
| ❸ | Red/yellow/green | Status indicator | STATE |

[1] Safety light curtains with protective field height > 300 mm have multiple LEDs for the field indicator.

### Receiver displays

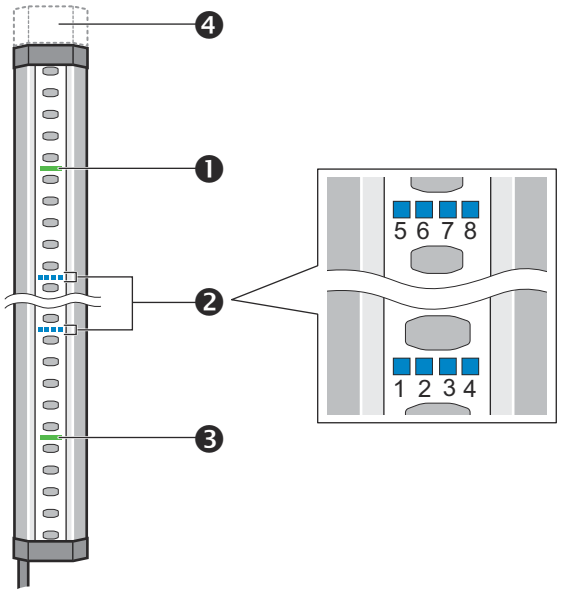



*Figure 6: Receiver indicators*

At least ten light emitting diodes on the receiver indicate the operational status:

| Position | LED color | Function | Labeling |
|---|---|---|---|
| ❶ | Red/yellow/green | Field indicator [1]; shows the status of the protective field and additional information about the status display | – |
| ❷ | Blue/red/yellow/white | Diagnostics | 1, 2, 3, 4, 5, 6, 7, 8 |
| ❸ | Red/green | OSSD status | OSSD |
| ❹ | Red/yellow/green | End cap with integrated LED (optional) | – |

[1] Safety light curtains with protective field height > 300 mm have multiple LEDs for the field indicator.

### Further topics

- "Diagnostic LEDs", page 124

## 3.2.20.1 Indication of diagnostic LEDs

*Table 7: Colors and their meaning*

| Color | Color | Meaning |
|---|---|---|
| ● | White | Configuration status |
| ● | Blue | Alignment quality |
| ● | Red | Fault indicator |
| ● | Yellow | Warning |

○ LED off. ☼ LED flashes. ● LED illuminates.

*Table 8: Indication of the configuration status*

| Diagnostic LEDs | Color | Configuration |
|---|---|---|
| 1 | ● White | External device monitoring (EDM) is configured. |
| 2 | ● White | Cascade with 1 or with 2 guest devices is configured. |
| 3 | ● White | Beam coding is configured. |
| 4 | ● White | Restart interlock is configured. |
| 5 | ● White | Muting or Smart Box Detection is configured. |
| 6 | ● White | Reduced resolution is configured. |
| 7 | ● White | Dynamic protective field width is configured. |
| 8 | ● White | Reserved |

○ LED off. ☼ LED flashes. ● LED illuminates.

*Table 9: Indication of the alignment quality*

| Diagnostic LEDs | Color | Meaning |
|---|---|---|
| 1 ... 4 | ● Blue | Indication of the alignment quality.<br>If only one diagnostic LED lights up, the alignment is insufficient. If all 4 diagnostic LEDs light up, the alignment is excellent. |
| 5, 6 | ● Blue | The topmost beam (far from system plug) is synchronized. |
| 7, 8 | ● Blue | The bottommost beam (near system plug) is synchronized. |

○ LED off. ☼ LED flashes. ● LED illuminates.

*Table 10: Fault indicator*

| Diagnostic LEDs | Color | Meaning |
|---|---|---|
| 1 ... 8 | ● Red | A red illuminated diagnostic LED signals the function at which an error has occurred. |
| 1 ... 8 | ☼ Red | A red flashing diagnostic LED signals the reason for the error. |

○ LED off. ☼ LED flashes. ● LED illuminates.

Example: If diagnostic LED 1 lights up red and diagnostic LED 5 flashes red, there is an EDM error.

*Table 11: Warnings*

| Diagnostics LED | Color | Meaning |
|---|---|---|
| 1 ... 8 | ● Yellow | A yellow illuminated diagnostic LED signals which function is affected. |
| 1 ... 8 | ☼ Yellow | A yellow flashing diagnostic LED signals the reason for the warning. |

○ LED off. ☼ LED flashes. ● LED illuminates.

Example: If diagnostic LED 5 lights up yellow and diagnostic LED 3 flashes yellow, the sensor gap monitoring was exceeded.

### Further topics

- "Diagnostic LEDs", page 124

## 3.3 Example applications

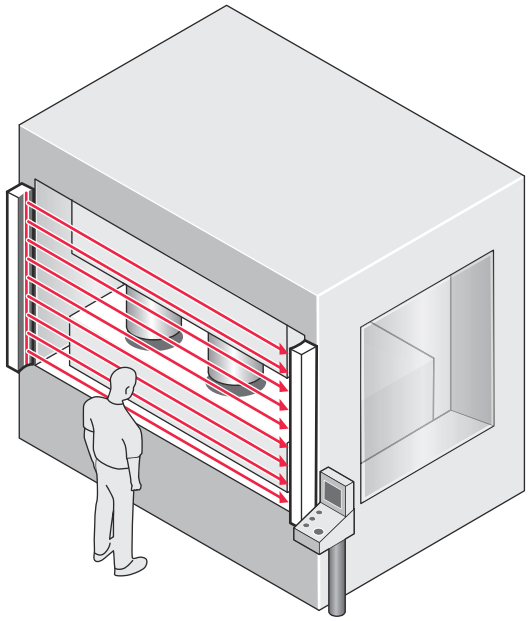


*Figure 7: Hazardous point protection*

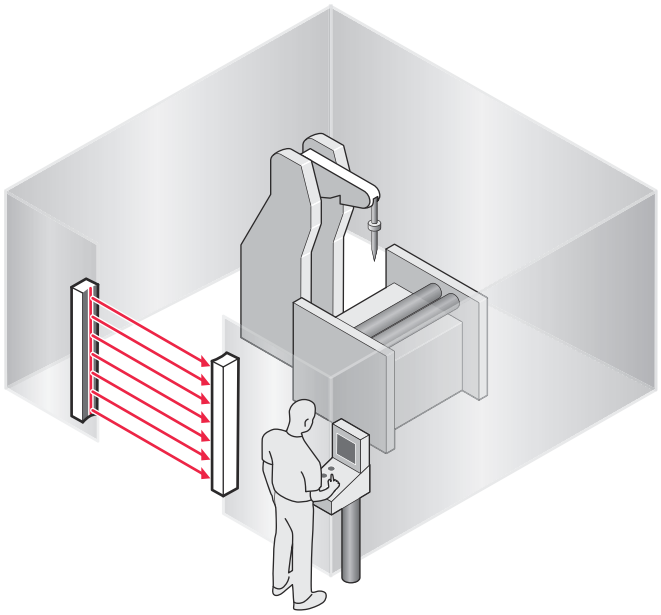


*Figure 8: Access protection*

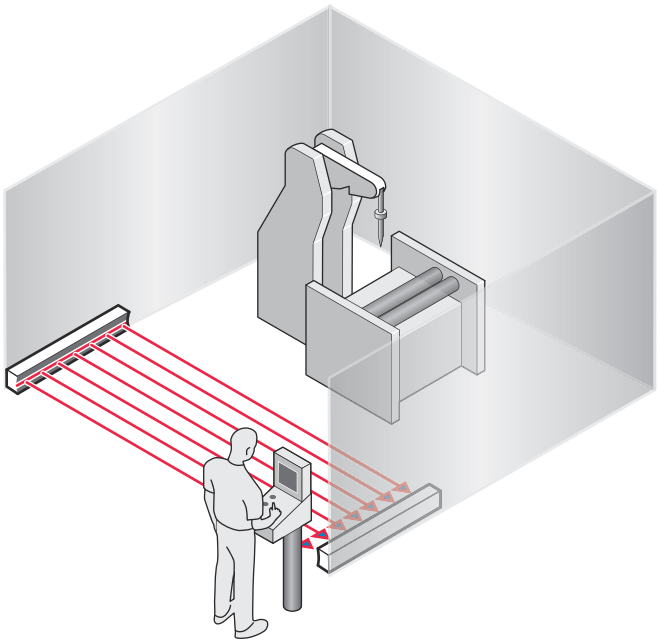


*Figure 9: Hazardous area protection*

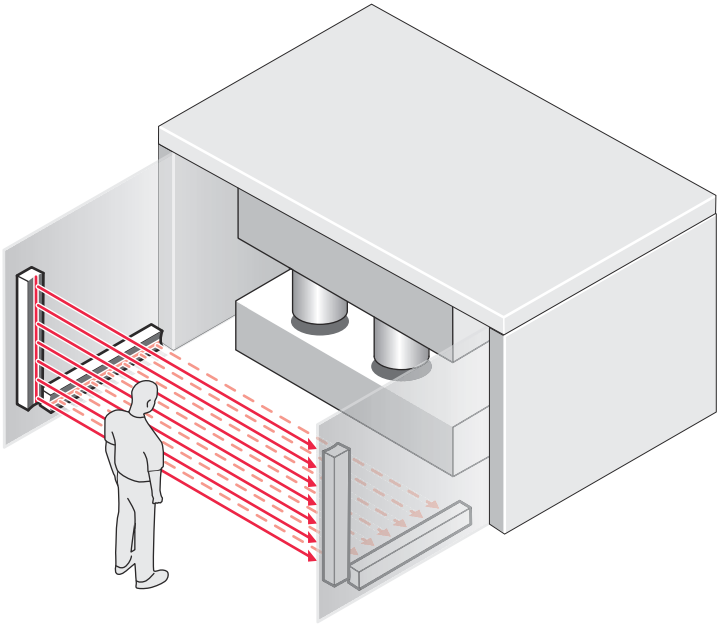


*Figure 10: Access protection with smart presence detection, implemented using cascade*

# 4 Project planning

## 4.1 Manufacturer of the machine

**DANGER**
Hazard due to lack of effectiveness of the protective device

Persons and parts of the body to be protected may not be recognized in case of non-observance.

- Conduct a risk assessment and check whether additional protective measures are required.
- Comply with the applicable national regulations derived from the application (e.g., work safety regulations, safety rules, or other relevant safety guidelines).
- Do not combine the components of the safety light curtain with components from other safety light curtains.
- Apart from for the procedures described in this document, the components of the safety light curtain must not be opened.
- The components of the safety light curtain must not be tampered with or changed.
- Do not carry out any repairs on the device components. Improper repair of the protective device can lead to a loss of the protective function.

## 4.2 Operator of the machine

**DANGER**
Hazard due to lack of effectiveness of the protective device

Persons and parts of the body to be protected may not be recognized in case of non-observance.

- Changes to the electrical integration of the safety light curtain in the machine controller and changes to the mechanical mounting of the safety light curtain require another risk assessment. The results of this risk assessment may require the entity operating the machine to meet the obligations of a manufacturer.
- Apart from for the procedures described in this document, the components of the safety light curtain must not be opened.
- The components of the safety light curtain must not be tampered with or changed.
- Do not carry out any repairs on the device components. Improper repair of the protective device can lead to a loss of the protective function.

## 4.3 Design

**Overview**

This chapter contains important information about the design.

**Important information**

**DANGER**
Hazard due to lack of effectiveness of the protective device

Persons and parts of the body to be protected may not be recognized in case of non-observance.

- ► Make sure that the following construction requirements are met so that the safety light curtain can fulfill its protective function.
  - Sender and receiver must be arranged such that persons or parts of the body are reliably detected when they enter the hazardous area.
  - Reaching under, over, and around as well as moving the safety light curtain must be prevented.
  - Check whether additional safety measures (e.g. restart interlocking) are necessary when it is possible for people to be located between the protection system and the danger point without being detected.

**DANGER**
Hazard due to lack of effectiveness of the protective device

Certain types of light radiation can influence the protective device, e.g., light radiation from fluorescent lamps with electronic ballast installed in the path of the beam, or beams from laser pointers directed at the receiver.

- ► If this type of light radiation is present in the environment of the protective device, take additional measures to ensure that the protective device does not become dangerous.

**DANGER**
Hazard due to lack of effectiveness of the protective device

Persons and parts of the body to be protected may not be recognized in case of non-observance.

- ► Make sure that the optical properties of the front screens of the sender and receiver are not changed, e.g., by:
  - beading water, mist, frost, or ice formation. If applicable, remove films or other types of contamination, disconnect the voltage supply of the receiver and then switch it back on.
  - Scratches or damage. Replace the device whose front screen is scratched or damaged.
- ► Make sure that all reflective surfaces and objects maintain a minimum distance from the protective field.
- ► Make sure that no dispersive media (e.g., dust, fog, or smoke) are within the calculated minimum distance from the protective field.

**Further topics**

- "Mounting", page 76

### 4.3.1 Scanning range and protective field width

**Protective field width**

The protective field width is the dimension of the light path between sender and receiver. The maximum protective field width is limited by the scanning range.

#### Scanning range

The scanning range limits the maximum protective field width. The protective field width can change during operation based on the corresponding setting.

The scanning range is reduced by using deflector mirrors.

The scanning range is reduced by using a weld spark guard.

**There are 2 ways to adjust the scanning range:**

- Automatic calibration of the protective field width
  When switched on, the safety light curtain automatically calibrates to the protective field width. The position of the safety light curtain may not change later.
- Dynamic protective field width
  A range is set for a dynamic protective field width. Within this range, the protective field width may change during operation.

#### Complementary information

Depending on the scanning range setting, a minimum distance to reflective surfaces must be maintained.

#### Further topics

- "Minimum distance to reflective surfaces", page 31
- "Technical data", page 140
- "Deflector mirrors", page 160
- "Weld spark guard", page 154

### 4.3.2 Minimum distance from the hazardous point

#### Overview

A minimum distance must be maintained between the safety light curtain and the hazardous point. This distance is required to prevent a person or part of their body from reaching the hazardous point before the end of the machine's dangerous state.

#### Calculation of the minimum distance according to ISO 13855

The calculation of the minimum distance is based on international or national standards and statutory requirements applicable at the place of installation of the machine.

If the minimum distance is calculated according to ISO 13855, then it depends on the following points:

- Machine stopping time (time interval between triggering the sensor function and the end of the machine's dangerous state)
- Response time of the protective device
- Reach or approach speed of the person
- Resolution (detection capability) of the safety light curtain
- Type of approach: orthogonal (at right angles) or parallel
- Parameters specified based on the application

For the USA (scope of OSHA and ANSI), different regulations may apply, e.g.:

a) Laws: Code of Federal Regulations, Title 29 (CFR 29), Part 1910.217

b) Standards: ANSI B11.19

#### Complementary information

More information is available in the ISO 13855 standard and in the Guide for Safe Machinery.

SICK offers a stopping/run-down time measurement service in many countries.

**Further topics**

- "Response time", page 145

#### 4.3.2.1 Calculating minimum distance from the hazardous point

**Important information**

**DANGER**
Minimum distance from the hazardous point is too small

The dangerous state of the machine may not be stopped or not be stopped in a timely manner due to a minimum distance that is too small.

- ► Calculate the minimum distances for the machine in which the safety light curtain is integrated.
- ► When mounting the safety light curtain, observe the minimum distance.

**NOTE**
If the safety light curtain is configured with a reduced resolution, then the minimum distance must be calculated according to the effective resolution in accordance with ISO 13855.

If the effective resolution is > 40 mm, a different formula may have to be used for the calculation of the minimum distance.

**NOTE**
If the Smart Box Detection function is configured on the safety light curtain, then a different formula must be used to calculate the minimum distance, see "Minimum distance to the hazardous point with Smart Box Detection", page 51.

**Approach**

The example shows the calculation of the minimum distance in accordance with ISO 13855 for an orthogonal (right-angled) approach to the protective field. A different calculation may be required depending on the application and the ambient conditions (e.g., for a protective field parallel to or at any angle to the direction of approach or an indirect approach).

1. First, calculate S using the following formula:
   $S = (K \times T) + 8 \times (d - 14\ mm)$
   Where:
   - S = minimum distance in millimeters (mm)
   - K = approach speed (stepping and/or gripping speed) of a person or a body part (mm/s), e.g. 2,000 mm/s
   - T = machine stopping time + response time of the protective device after interruption in the light path in seconds (s)
   - d = resolution of the safety light curtain in millimeters (mm)
2. If the result S is ≤ 500 mm, then use the determined value as the minimum distance.
3. If the result S is > 500 mm, then recalculate S with an approach speed of 1,600 mm/s as follows:
   $S = 1{,}600\ mm/s \times T + 8 \times (d - 14\ mm)$
4. If the new value S is > 500 mm, then use the newly determined value as the minimum distance.
5. If the new value S is ≤ 500 mm, then use 500 mm.

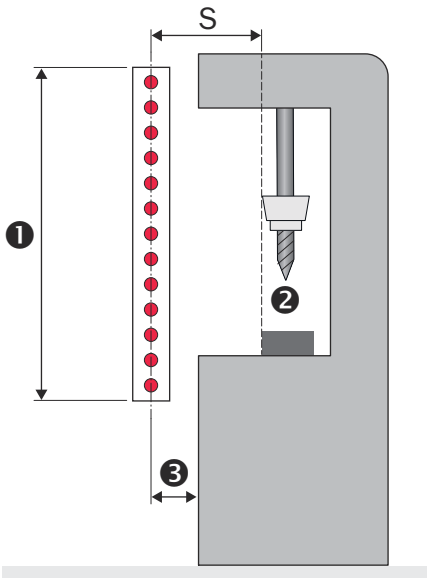



*Figure 11: Minimum distance to the hazardous point for orthogonal (rectangular) approach to the protective field*

❶ Protective field height

❷ Hazardous point

❸ Depending on the application and distance, persons must be prevented from standing behind the protective device.

**Example calculation**

Machine stopping time = 290 ms

Response time after interruption of the light path = 30 ms

Resolution of the safety light curtain = 14 mm

T = 290 ms + 30 ms = 320 ms = 0.32 s

S = 2,000 mm/s × 0.32 s + 8 × (14 mm – 14 mm) = 640 mm

S > 500 mm, therefore:

S = 1,600 mm/s × 0.32 s + 8 × (14 mm – 14 mm) = 512 mm

#### 4.3.2.2 Taking reach over into account

In accordance with ISO 13855, it must not be possible to defeat the ESPE. If access to the hazardous area by reaching over a protective field cannot be prevented, the height of the protective field and minimum distance of the ESPE must be determined. This is done by comparing the calculated values based on the possible detection of limbs or body parts with the values resulting from reaching over the protective field. The greater value resulting from this comparison must be used.

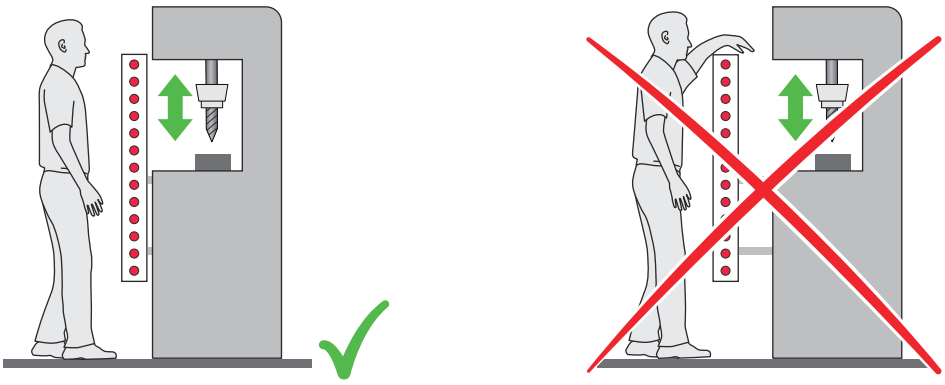


*Figure 12: Representation of the accessibility of ESPE by reaching over. Left: Protective field that cannot be reached over. Right: Protective field that can be reached over.*

### 4.3.3 Minimum distance to reflective surfaces

#### Overview

The light beams from the sender may be deflected by reflective surfaces and dispersive media. This may prevent an object from being detected.

Therefore, all reflective surfaces and objects (e.g. material bins, machine table, etc.) must maintain a minimum distance (a) from the protective field. This minimum distance (a) must be maintained on all sides of the protective field. This applies in horizontal, vertical and diagonal directions as well as at the end of the safety light curtain. The same area must be free of dispersive media (e.g., dust, fog, or smoke).

The minimum distance (a) depends on the distance (D) between sender and receiver (protective field width).

The weld spark guard can influence the optical properties of the safety light curtain, meaning that reflective surfaces have to observe a larger minimum distance.

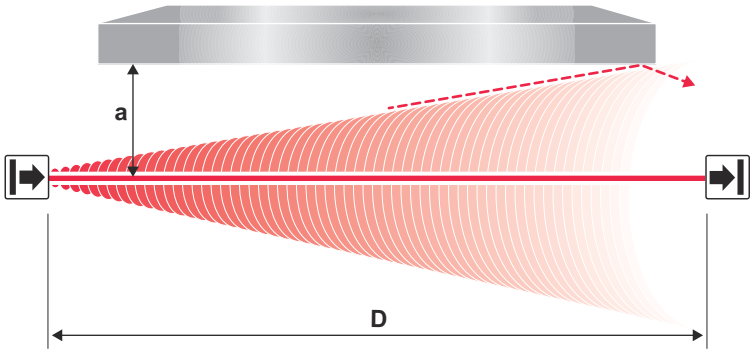



*Figure 13: Minimum distance from reflective surfaces*

### Important information

**DANGER**

Hazard due to lack of effectiveness of the protective device

Reflective surfaces and dispersive media can prevent persons or parts of the body to be protected from being properly reflected and therefore, they remain undetected.

- ► Make sure that all reflective surfaces and objects maintain a minimum distance from the protective field.
- ► Ensure that no reflective objects are in the protective field.
- ► Make sure that no dispersive media (e.g., dust, fog, or smoke) are within the calculated minimum distance from the protective field.
- ► Ensure that the correct formula is used for the calculation of the minimum distance.
- ► Ensure that the minimum distance to reflective surfaces is recalculated after a change to the scanning range configuration.

### Determining minimum distance from reflective surfaces with automated calibration of the protective field width

**The minimum distance can be determined as follows:**

- ► Determine the distance between sender and receiver D in meters (m).
- ► Read the minimum distance a in millimeters (mm) in the graph or calculate using the respective formula to determine the minimum distance to reflective surfaces:

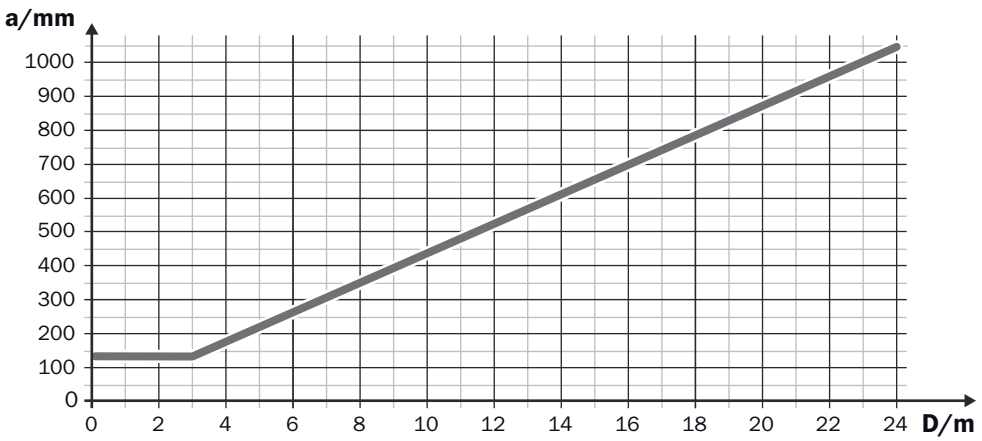



*Figure 14: Graph of minimum distance from reflective surfaces*

*Table 12: Formula for calculating the minimum distance to reflective surfaces with automatic calibration of the protective field width*

| Distance D between sender and receiver in m | Calculation of the minimum distance (a) to reflective surfaces in mm |
|---|---|
| D ≤ 3 m | a = 131 mm |
| D > 3 m | a = tan (2.5°) × 1,000 mm/m × D = 43.66 × 1 mm/m × D |

### Determining the minimum distance to reflective surfaces with dynamic protective field width

**The minimum distance can be determined as follows:**

- ► Determine the distance between sender and receiver D in meters (m).
- ► Calculate minimum distance a in millimeters (mm) based on the corresponding formula from table 13 or table 14:

*Table 13: Formula for calculating the minimum distance to reflective surfaces with dynamic protective field width (resolution 14 mm)*

| Dynamic protective field width | Distance D between sender and receiver in m | Calculation of the minimum distance (a) from reflective surfaces in mm |
|---|---|---|
| Small range: 0.15 m ... 4 m | D ≤ 3 m | a = 131 mm |
| | D > 3 m | a = tan (2.5°) × 1,000 mm/m × D = 43.66 × 1 mm/m × D |
| Medium range: 1 m ... 8 m | D ≤ 4 m | a = 175 mm |
| | D > 4 m | a = tan (2.5°) × 1,000 mm/m × D = 43.66 × 1 mm/m × D |
| Large range: 2 m ... 16 m | D ≤ 8 m | a = 350 mm |
| | D > 8 m | a = tan (2.5°) × 1,000 mm/m × D = 43.66 × 1 mm/m × D |

*Table 14: Formula for calculating the minimum distance to reflective surfaces with dynamic protective field width (resolution 30 mm)*

| Dynamic protective field width | Distance D between sender and receiver in m | Calculation of the minimum distance (a) from reflective surfaces in mm |
|---|---|---|
| Small range: 0 m ... 6 m | D ≤ 3 m | a = 131 mm |
| | D > 3 m | a = tan (2.5°) × 1,000 mm/m × D = 43.66 × 1 mm/m × D |
| Medium range: 0 m ... 12 m | D ≤ 6 m | a = 262 mm |
| | D > 6 m | a = tan (2.5°) × 1,000 mm/m × D = 43.66 × 1 mm/m × D |
| Large range: 0 m ... 24 m | D ≤ 12 m | a = 524 mm |
| | D > 12 m | a = tan (2.5°) × 1,000 mm/m × D = 43.66 × 1 mm/m × D |

**Further topics**

- "Weld spark guard", page 154

### 4.3.4 Protection against interference from systems in close proximity to each other

**Overview**

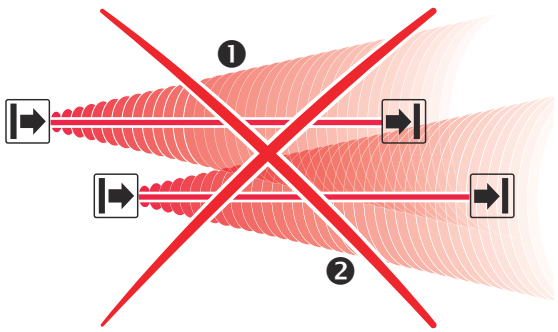



*Figure 15: Preventing mutual interference from system ① and system ②*

The infrared light beams of the sender of system ① can interfere with the receiver of system ②. This can disrupt the protective function of system ②. This would mean that the operator is at risk.

**Important information**

**DANGER**
Hazard due to lack of effectiveness of the protective device

The integrated laser alignment aid may influence the receiver of a safety light curtain in close proximity. In such cases, the neighboring safety light curtain may not detect persons or parts of the body that require protection.

- ► Perform an alignment or take other measures to ensure that the laser beam only hits the front screen of the relevant receiver. The laser beam must not hit any external receiver should the integrated laser alignment aid be switched on by mistake or due to a fault. An external receiver is a receiver that is not part of the same safety light curtain or same cascade.
- ► During alignment in particular, make sure that the laser beam does not hit any external receiver.

**DANGER**
Hazard due to lack of effectiveness of the protective device

Systems of safety light curtains in close proximity to each other can mutually interfere with each other.

- ► Use appropriate measures to prevent systems in close proximity from interfering with each other.

**Preventing interference between systems in close proximity to each other**

**The following measures prevent interference from systems in close proximity:**

- Different beam coding for neighboring systems
- Reversed direction of transmission for neighboring systems
- Sender with a small scanning range
- Optically opaque partitions

**Further topics**

- "Using beam coding", page 34
- "Using reversed direction of transmission", page 35
- "Using a sender with a small scanning range", page 36

### 4.3.4.1 Using beam coding

**Important information**

**DANGER**
Hazard due to lack of effectiveness of the protective device

Different beam codings only prevent mutual interference if both safety light curtains are of type deTec4.

- ► In the case of systems in close proximity that are of a different type, take different measures to prevent mutual interference.

**DANGER**
Hazard due to lack of effectiveness of the protective device

A safety light curtain with the beam coding “uncoded” can be affected by senders with code 1 or code 2.

A safety light curtain with code 1 or code 2 can be affected by senders with the beam coding “uncoded”.

Safety light curtains with the same beam coding can interfere with each other.

► If systems are in close proximity to each other, only use code 1 and code 2.

**Using beam coding**

Use suitable beam codings to prevent mutual interference from neighboring systems.

► Configure one safety light curtain with code 1 and the other safety light curtain with code 2.

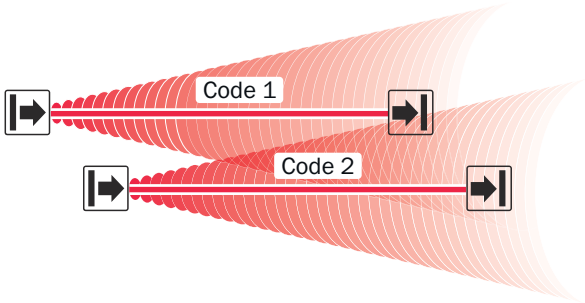



*Figure 16: Trouble-free operation due to beam coding*

In the figure, the beam coding of systems in close proximity to each other is different. The system with code 2 is not affected by the beams of the system with code 1.

**Further topics**

- "Configuring beam coding", page 96
- "Combining beam coding and reversed direction of transmission", page 36

### 4.3.4.2 Using reversed direction of transmission

**Important information**

**NOTE**
The direction of transmission of the system can be changed during installation by switching the positions of the sender and receiver. The sender and receiver are easy to exchange with each other if they are wired in the same way.

**Using reversed direction of transmission**

The direction of transmission of the system ❷ can be changed during mounting by switching the positions of the sender and receiver. With reversed direction of mounting, the receiver ❷ is not affected by the infrared light from the sender ❶.

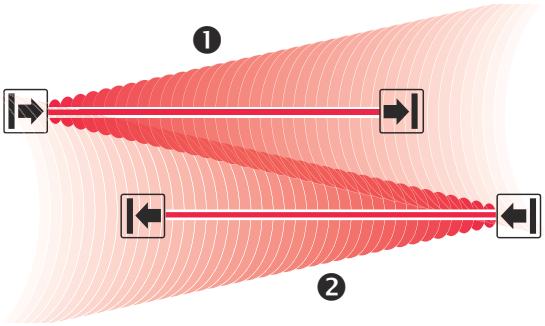



*Figure 17: Trouble-free operation due to reversed direction of transmission of system ① and system ②*

**Further topics**

- "Connection of sender and receiver", page 59
- "Combining beam coding and reversed direction of transmission", page 36

### 4.3.4.3 Combining beam coding and reversed direction of transmission

To prevent a mutual interference in the case of more than two neighboring systems, beam coding and reversed direction of transmission can be combined.

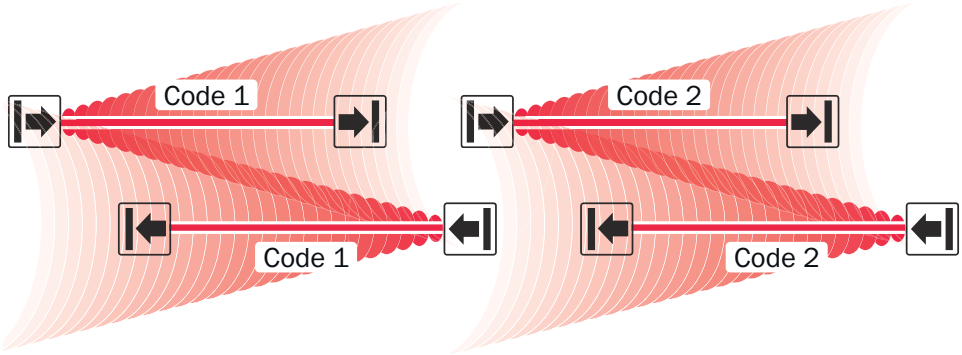



*Figure 18: Trouble-free operation of 4 neighboring systems due to beam coding and reversed direction of transmission*

In the figure, the beam coding of the systems arranged next to each other is different. The direction of transmission of the systems arranged on top of each other is reversed. This prevents the systems from interfering with each other.

### 4.3.4.4 Using a sender with a small scanning range

**Overview**

In order to prevent mutual interference of systems, a sender with a small scanning range can be used.

### Important information

**DANGER**
Hazard due to lack of effectiveness of the protective device

Persons and parts of the body to be protected may not be recognized in case of non-observance.

- ► Immediately shut the machine down if the behavior of the machine cannot be clearly identified.
- ► Immediately put the machine out of operation if you cannot clearly identify or allocate the fault and if you cannot safely remedy the fault.
- ► Secure the machine so that it cannot switch on unintentionally.

### Prerequisites

- System plug SP2 on receiver of a single or host system

### Using a sender with a small scanning range

The scanning range of the system is permanently set to 2 m if a sender with a small scanning range is being used. This requires the small range (dynamic protective field width) to be configured using the DIP switches at the receiver of an individual system or host system too.

If multiple systems with a small scanning range and working in the same direction of transmission are being used, a minimum distance B of 6 m must be maintained between a sender $S_1$ and a receiver $R_2$ of a neighboring system.

- ► At the receiver of an individual system or host system, configure the small range (dynamic protective field width) using the DIP switches.
- ► Maintain a minimum distance B of 6 m between a sender $S_1$ and a receiver $R_2$ of a neighboring system with the same direction of transmission.


*Figure 19: Trouble-free operation with sufficient distance where the same direction of transmission applies*

**$S_1$** System sender with small scanning range ①
**$R_1$** System receiver ①
**$S_2$** System sender with small scanning range ②
**$R_2$** System receiver ②
**B** Minimum distance between sender of the first system and receiver of the second system with the same direction of transmission

### Further topics

- "Configuring the scanning range", page 98
- "Data sheet", page 140
- "Ordering information", page 150

### 4.3.5 Reduced resolution

#### Overview

Using a reduced resolution, up to 2 adjacent beams can be interrupted without the OSSDs switching to the OFF state.

As a result, smaller objects can move into the detection area of the safety light curtain without the curtain reacting and the machine switching off. For this purpose, the permitted resolution is reduced by up to 2 beams.

The reduced resolution can be used for suppressing interference objects, if, for instance, cables or hoses need to be routed through the protective field. The function can be configured during commissioning.

#### Important information

**NOTE**
If the safety light curtain is configured with a reduced resolution, then the minimum distance must be calculated according to the effective resolution in accordance with ISO 13855.
If the effective resolution is > 40 mm, a different formula may have to be used for the calculation of the minimum distance.

**NOTE**
If a reduced resolution and automatic calibration of the protective field width is configured, no objects may be in the protective field upon activation. Otherwise, this may influence the automatic calibration of the protective field width.

**NOTE**
When reduced resolution is configured, the effective resolution must be marked on the device and on the machine by taking suitable measures, e.g. a mark or an information label provided by SICK. The information label is available as an accessory.

**NOTE**
If reduced resolution and Smart Box Detection are configured, different effective resolutions apply to the safety light curtain, see "Effective resolution with Smart Box Detection", page 52.

#### Effective resolution with reduced resolution

The effective resolution of the safety light curtain changes due to the reduced resolution. Objects up to a certain height can move in the detection zone of the safety light curtain without the beams being interrupted and the machine switching off.

*Table 15: Effective resolution with reduced resolution*

| Physical resolution | Reduction | Effective resolution | Maximum size of moving objects |
|---|---|---|---|
| 14 mm | 1 beam | 24 mm | 10 mm |
| | 2 beams | 34 mm | 20 mm |
| 30 mm | 1 beam | 55 mm | 25 mm |
| | 2 beams | 80 mm | 50 mm |

#### Further topics

- "Minimum distance from the hazardous point", page 28
- "Additional accessories", page 164

### 4.3.6 Muting

#### Overview

Muting temporarily bypasses the protective action of the safety light curtain so that material can be transported to or from a machine or system. As a result, the work process remains uninterrupted. The function can be configured during commissioning.

The distinction between people and materials is made by 2 signals that are independent of each other. Based on the logical evaluation of these signals, the protective device is bypassed if a valid muting condition is present. As soon as something other than material enters the hazardous area, the work process is interrupted.

#### Prerequisites

- Muting may only be activated during the period in which the material to be transported (e.g. on a pallet) is blocking access to the hazardous area
- Muting must be automatic, i.e., not manual
- Muting must not depend on a single electrical signal
- Muting must be triggered by at least 2 signals wired independently of each other (e.g. by muting sensors)
- Muting must not depend entirely on software signals (e.g. from a PLC)
- Muting must be reversed after the material has passed through in order that the protective device becomes effective again
- The material to be transported must be detected above a certain length, i.e., an interruption of the muting signals must not last longer than 500 ms
- Attach muting sensors as appropriate to prevent muting from being triggered by someone unintentionally

### 4.3.6.1 Muting sensors

#### Overview

Muting sensors detect material and supply the signals required by an evaluation unit for the logical linking.

**Muting signals can be generated in the following ways:**

- Optical sensors
- Inductive sensors
- Mechanical switches
- Controller signals

#### Arranging muting sensors

**The following is to be observed in the arrangement of muting sensors:**

- Muting sensors must be arranged so that only the material is detected and not the means of transport or conveyor (vehicle or pallet)
- Muting sensors must be arranged so that material can pass the ESPE unimpeded, although persons are safely detected by the ESPE
- Muting sensors must be arranged so that they detect the material with a minimum distance in front of the ESPE. The minimum distance ensures the required processing time until muting is activated.
- If a muting connector is not used and both muting signals are on the extension connection, the muting sensors must be arranged so that the signals arrive at the device at different times

### 4.3.6.2 Muting variants

#### 4.3.6.2.1 Cross muting

**Overview**

For muting using a crossed arrangement of the muting sensors, material can move either from left to right or from right to left, i.e., material flow is possible in both directions.

**Arrangement of the muting sensors**

- ► Place the crossing point of the muting sensors directly on the path of the beams of the ESPE.
- ► If this is not possible, place the crossing point in the direction of the hazardous area.

The signals of the muting sensors are on the extension connection. Alternatively, the input of a muting signal can be moved to the system connection.

**Principle of operation**

Once muting sensors A1 and A2 are actuated, muting is active.

Muting remains active until one of the muting sensors becomes clear.

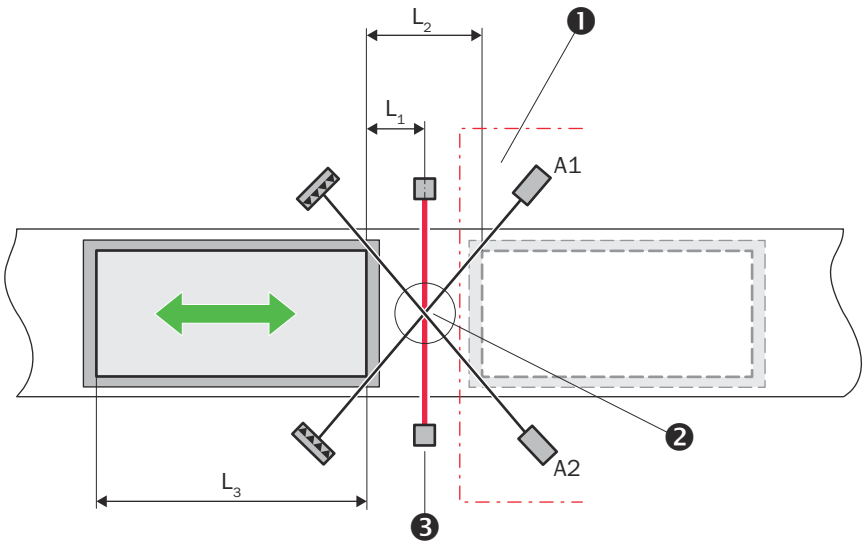



*Figure 20: Cross muting*

❶ Hazardous area
❷ Crossing point for the muting sensors
❸ ESPE

**The following applies to cross-muting:**

- Override is active. The number of override statuses is limited to 5.
- Concurrence monitoring is configured
- A total muting time is active
- The muting signal inputs are monitored for cross-circuits
- Cross-muting ends if one of the two muting sensors has become clear and the sensor gap monitoring of 0.5 s has passed

**Calculating minimum distance**

**Calculating minimum distance without using a muting connector:**

- $L_1 \geq v \times 0.060\ s$

Calculating minimum distance with use of a muting connector:

- $L_1 \geq v \times 0.122$ s

The following rules apply:

- $L_1$ = Minimum distance between the beams of the ESPE and the detection of the muting sensors in m
- v = Speed of the material (e.g. material on a conveyor belt in m/s)

#### Complementary information

Cross-muting can be combined with partial blanking.

A muting signal can be shifted by the extension connection on the system connection.

#### Further topics

- "Data sheet", page 140
- "Override", page 43
- "Sensor gap monitoring", page 45
- "Cross-circuit monitoring", page 46
- "End of muting by ESPE", page 44

### 4.3.6.2.2 Exit monitoring

#### Overview

Exit monitoring checks that only material moves out of the hazardous area, while persons cannot enter the dangerous area.

#### Arrangement of the muting sensors

The muting sensors must be arranged so that the entire lengths of both the material and the means of transport are detected by the sensors or the ESPE. There may not be any detectable gaps, otherwise muting is ended too soon (reduced system availability).

► Position muting sensors on the side of the hazardous area.

**NOTE**
Prevent mutual sensor interference.

The signals of the muting sensors are on the extension connection. Alternatively, the input of a muting signal can be moved to the system connection.

#### Principle of operation

The muting sensors (A1 and A2) are arranged serially in the hazardous area and detect material before it passes through the ESPE ②.

Once muting sensors A1 and A2 are actuated, muting is active.

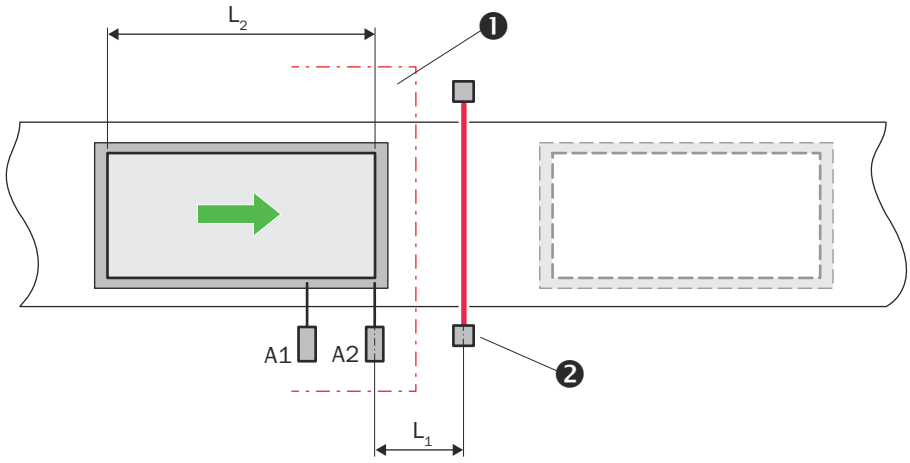



*Figure 21: Exit monitoring*

❶ Hazardous area

❷ ESPE

**The following is true for exit monitoring:**

- Override is active. The number of override statuses is limited to 5.
- The muting end by ESPE function is active
- Concurrence monitoring is configured
- A total muting time is active
- The muting signal inputs are monitored for cross-circuits
- If the ESPE does not always detect a muting end caused by irregularities in the material or the means of transport exactly, muting is ended after a muting end delay of 200 ms at the latest
- If a muting sensor is clear, sensor gap monitoring will expire, meaning that a muting sensor may not be clear longer than 0.5 s
- If the sensor gap monitoring of 0.5 s has been exceeded, muting ends after a muting hold time of 4 s

Exit monitoring can be combined with partial blanking.

### Calculating minimum distance

**Calculating minimum distance without using a muting connector:**

- $L_1 \geq v \times 0.060$ s
- $v \times t > L_1 + L_2$

**Calculating minimum distance with use of a muting connector:**

- $L_1 \geq v \times 0.122$ s
- $v \times t > L_1 + L_2$

**The following rules apply:**

- $L_1$ < 200 mm; minimum distance between the beams of the ESPE and the detection of the muting sensors in m
- v = Speed of the material (e.g. of the conveyor belt) in m/s
- t = Muting hold time in s (with active muting end by ESPE function)
- $L_2$ = Length of the material in conveying direction in m

### Further topics


- "Cross-circuit monitoring", page 46
- "Data sheet", page 140

#### 4.3.6.3 Override

**Overview**

An override is a manual muting triggering after an error in the muting conditions. The protective device is bypassed and the system can be cleared and an error-free status can be achieved.

Override is always active if muting has been configured.

**Important information**

**NOTE**

If automatic measurement of the protective field width is configured and the protective field is interrupted when the ESPE is switched on for the first time, the system changes to the override condition if the override conditions are fulfilled. If override is performed, the OSSDs change to the OFF state again after the protective field frees up again, if necessary, until the protective field width is automatically measured.

Configure a dynamic protective field width to bypass this behavior.

**Prerequisites**

- The override control switch is mounted outside of the hazardous area so that it cannot be actuated by a person that is inside the hazardous area.
- The operator can oversee the entire hazardous area when actuating the control switch.

**Performing an override with the integrated override function**

An error occurs while a muting condition is valid. The cause of the error is indicated by the LEDs on the receiver. If an optional muting light is connected, this muting light also flashes.

At the same time, the output signal switching devices (OSSDs) switch to the OFF status. The system is in the override required status and waits for the operator to actuate the override control switch or for the cause to be remedied in another way, e.g. for the belt to be cleared.

**The status override required is only triggered by the system if the following 3 conditions are present:**

- An error occurs, i.e. at least one muting sensor is active and at least one is inactive
- Muting ends
- The ESPE is interrupted by an object

**Performing an override**

The system is in the override required status after an error. Muting can only continue at the point where it was interrupted if the operator starts the integrated override function using the control switch. Then, the output signal switching devices (OSSDs) change to the ON status and the system monitors the override status.

If reset and override are configured, both functions are started using a common control switch.

**Monitoring override statuses**

For reasons of safety, the number of override statuses is limited to 5. The system automatically resets the counter each time the system is activated and after every error-free muting cycle without an override.

If the permitted number of override statuses has been exceeded, the system then switches to the locking status and displays an error message.

### 4.3.6.4 Time monitoring

#### 4.3.6.4.1 Muting hold time

A muting hold time is active in combination with the exit monitoring function.

If one of the muting sensors in the hazardous area is no longer engaged and the sensor gap monitoring of 0.5 s has been exceeded, the muting hold time of 4 s begins. ESPE protection is bypassed within this time period and material or a means of transport can pass through the ESPE without the machine stopping.

Muting ends if the muting hold time of 4 s has passed.

#### 4.3.6.4.2 End of muting by ESPE

**Important information**

**DANGER**

Muting end by ESPE delayed or ineffective

If automatic measurement of the protective field width is configured and the protective field is interrupted when the ESPE is switched on for the first time, the muting-end function by ESPE is delayed or ineffective.

► Configure a dynamic protective field width.

**Principle of operation**

Using the muting end by ESPE function, exit monitoring ends if the ESPE is clear again (①) and a sensor gap monitoring of 0.5 s has passed. This results in a shorter muting time and greater safety at the same time.

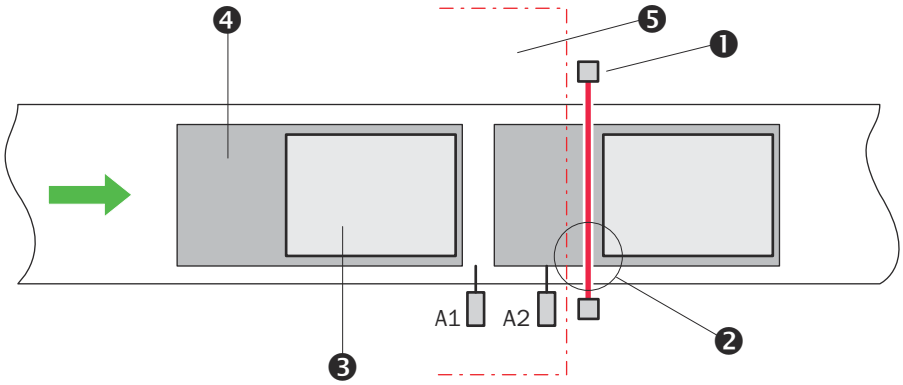



*Figure 22: Muting ends as soon as the ESPE is clear again*

❶ ESPE
❷ Time at which muting ends
❸ Material
❹ Transportation equipment
❺ Hazardous area

**The following applies to the muting end by ESPE function:**

- The entire length of the material and means of transport must be detected by the muting sensors or the ESPE
- Exit monitoring is ended too early if one of the muting sensors remains clear for longer than 0.5 s, i.e. the sensor gap monitoring has been exceeded

- If the ESPE is clear, exit monitoring is ended after the sensor gap monitoring of 0.5 s has passed
- If the light path of the ESPE does not become clear, exit monitoring is ended at the latest once the muting condition is no longer satisfied

#### 4.3.6.4.3 Sensor gap monitoring

**Overview**

Sensor gap monitoring allows signals from the muting sensors and the muting end by ESPE function to be ignored for a defined period without removing a valid muting condition.

**Sensor gap monitoring (muting sensor)**

If a muting sensor briefly becomes clear, i.e. an object gap is detected, the deactivated muting signal continues to be interpreted as an active signal and muting is maintained.

Muting is only ended if one of the muting sensors is clear for longer than 0.5 s.

The following applies to sensor gap monitoring (muting sensor)

- Sensor gap monitoring is always active
- Only one of the muting sensors may be clear (deactivated) briefly. If the 2nd muting sensor is also clear, muting is ended.
- Muting is ended if one of the muting sensors is clear (deactivated) for longer than 0.5 s

**Sensor gap monitoring (ESPE)**

If the ESPE is becomes clear for a short time, i.e. an object gap is detected, muting is maintained.

Muting is only ended if the ESPE is clear for longer than 0.5 s.

The following applies to sensor gap monitoring (ESPE):

- Sensor gap monitoring (ESPE) is active during exit monitoring in combination with the muting end by ESPE function
- The ESPE is allowed to be clear for a short time, i.e. to detect a short object gap
- Muting is ended if the ESPE is clear for longer than 0.5 s

#### 4.3.6.4.4 Concurrence monitoring

**Overview**

Concurrence monitoring is configured for protecting the safety application from tampering (e.g. covering an optical sensor).

**Principle of operation**

Concurrence monitoring checks whether both muting sensors are actuated within 24 hours. If a muting signal does not appear within this period, muting is not triggered. Muting can only be triggered again if all muting sensors are clear.

Concurrence monitoring is always active.

#### 4.3.6.4.5 Total muting time

The total muting time limits the maximum duration of muting to 24 hours, i.e. muting then ends at the latest once the total muting time has passed. The system then changes to the override required status.

The total muting time is always active.

#### 4.3.6.4.6 Cross-circuit monitoring

**Overview**

The muting signal inputs are monitored for cross-circuits.

The device expects the muting signals to arrive at different times. If the muting signals are detected simultaneously by the device, the OSSDs switch to the OFF status.

► Arrange muting sensors so that the muting signals arrive at the device at different times

**Important information**

**NOTE**
If a muting connector is used or one signal is on the system connection and the 2nd signal on the extension connection, the muting sensors do not have to be arranged with an offset.

**Further topics**

- "Accessories", page 153

### 4.3.6.5 Partial blanking

In comparison to muting, the partial blanking function allows safety to be increased by having the topmost beam (far from system plug) remain active during a valid muting condition. All other beams are temporarily bypassed (e.g. for a certain object height). As soon as the topmost beam is interrupted, the OSSDs switch to the OFF status.

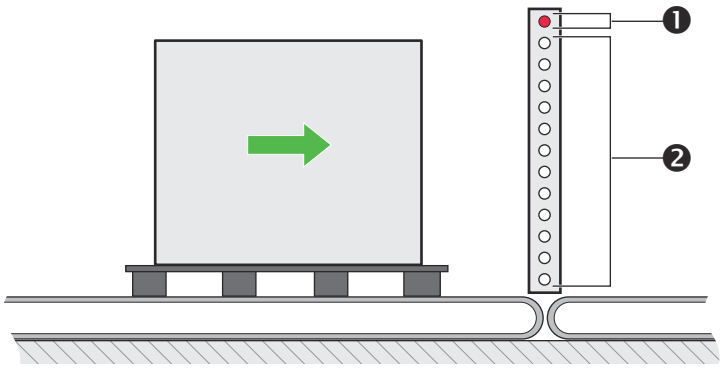



*Figure 23: Partial blanking*

❶ Active beam
❷ Inactive beams

**The following is true for partial blanking:**

- The active beam can be bypassed by override even if partial blanking is configured
- Partial blanking cannot be combined with a reduced resolution

### 4.3.6.6 Distributing muting signals

In the regular configuration, the muting signals are at In1 and In2 of the extension connection. If both muting signals are actuated, muting is active.

However, if a muting signal is to be supplied by the control system, muting signal 1 can be moved from In1 of the extension connection to In4 of the system connection (system plug SP2 M12, 8-pin). Once the muting sensor is actuated and the control system supplies a signal, muting is active. EDM is then not possible on the system and extension connection.

### Further topics

- "System connection (M12, 8-pin)", page 88
- "Extension connection (M12, 5-pin)", page 89

## 4.3.7 Smart Box Detection

### Overview

Smart Box Detection enables human-material differentiation by conveying only geometrically uniform objects to or from a plant or machine.

The protective field always remains active, meaning interruption in the protective field above an object is reliably detected by the protective device and the dangerous machine state is stopped.

Smart Box Detection can only be configured on safety light curtains with a 14 mm resolution.

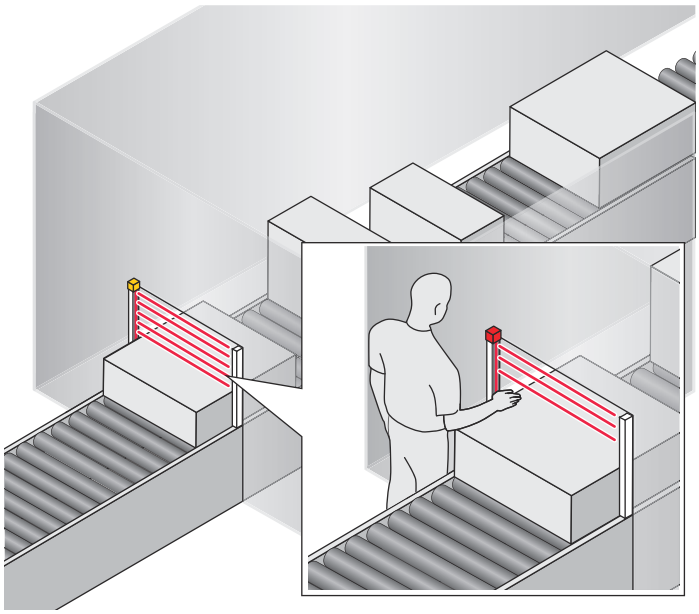


*Figure 24: Smart Box Detection application example*

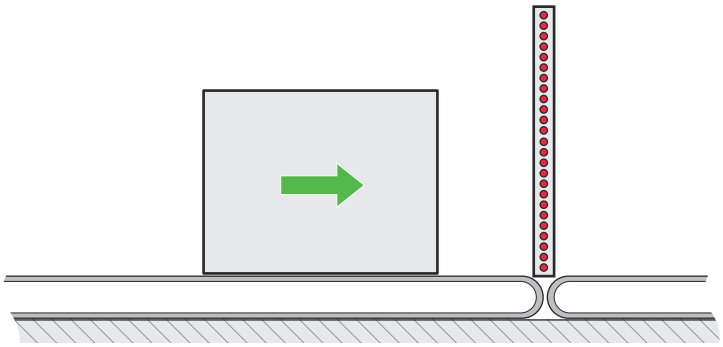
### Important information

**NOTE**

Smart Box Detection is only available on devices with the range of functions 1.1.0, see "Version numbers and range of functions", page 140.

### Prerequisites

- The objects cast a rectangular shadow without gaps (geometrically uniform objects) when passing through the protective field.
- The objects must have a defined minimum height and minimum width and maintain a defined minimum distance from each other.
- The object velocity is 0.1 m/s ... 1 m/s.
- The safety light curtain is mounted perpendicular to the conveyor plane for optimum availability.
- The lower edge of the housing is flush with the transport level.



- The object blocks access to the hazardous area. Lateral interruption in the protective field is not possible.
- Smart Box Detection may only be used in applications where it is ruled out that people or body parts can be recognized as valid objects, e.g. due to their work clothes or due to deliberate manipulation of the protective device.

**Functionality**

The protective device detects objects that cast a rectangular shadow without gaps when passing through.

If, on the other hand, other objects, especially persons, enter the protective field, the protective device detects the deviation from a valid object. The dangerous machine state is stopped.

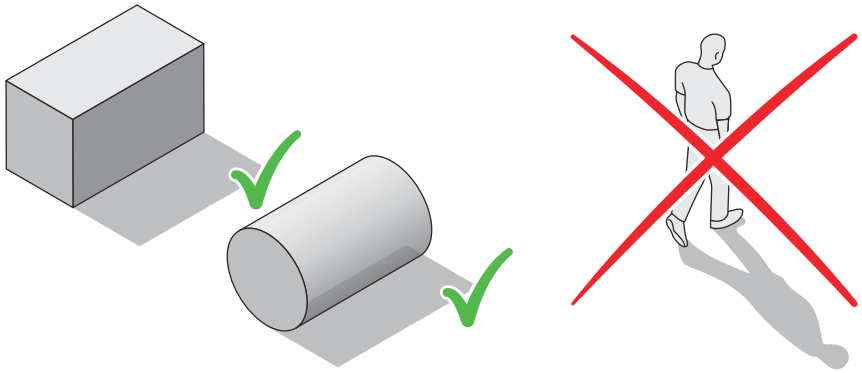


*Figure 25: Left: Rectangular shadow without gaps. Right: Shadow with gaps.*

If Smart Box Detection is configured, the protective field always remains active. Interruption in the protective field above a valid object is reliably detected by the protective device and the dangerous machine state is stopped.

#### 4.3.7.1 Object properties

**Overview**

Smart Box Detection allows geometrically uniform objects to pass through the protective field that have a certain minimum size.

Objects in reality often have odd object edges or are damaged, e.g. the transport box is torn or dented. Smart Box Detection therefore also allows objects whose upper and lower and lateral object edges are within a certain tolerance zone (increased availability of the system).

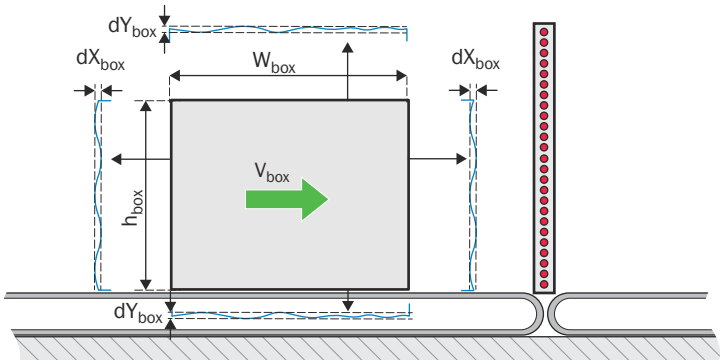



*Figure 26: Smart Box Detection: Object properties*

### Permitted object properties

*Table 16: Permitted object properties*

| Icon | Name | Value |
|---|---|---|
| $h_{box}$ | Object height | 134 mm ... (protective field height - 54) mm |
| $w_{box}$ | Object width | min. 10 mm ... 100 mm [1] |
| $dY_{box}$ | Upper and lower object edge tolerance (object height) | At least 10 mm [2] |
| $dX_{box}$ | Lateral object edge tolerance (object width) [3] | min. 6 mm ... 60 mm (uncoded system)<br>min. 4 mm ... 40 mm (coded system) |
| $v_{box}$ | Object speed | 0.1 m/s ... 1 m/s |
| $a_{box}$ | Object distance | min. 10 mm ... 100 mm |

1) The values depend on the object speed.
2) The values depend on the reduced resolution.
3) The values depend on the object speed and the set beam coding.

### Object edge tolerance

Increased availability of the system is possible due to the object edge tolerance. Objects that have been damaged during transport, for example, can pass through the protective field despite odd object edges as long as the defined tolerance zones are not exceeded.

The lateral object edge tolerance is proportional to the object speed. The faster the object speed ($v_{box}$), the greater the lateral object edge tolerance, see figure 27, page 50 and see figure 28, page 50.

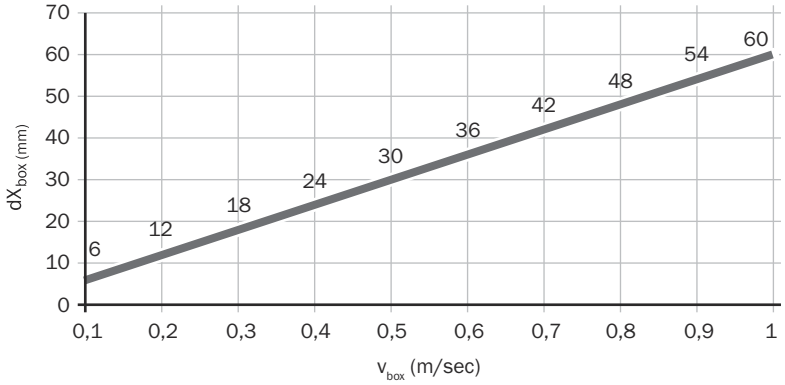



*Figure 27: Lateral object edge tolerance for an uncoded system*

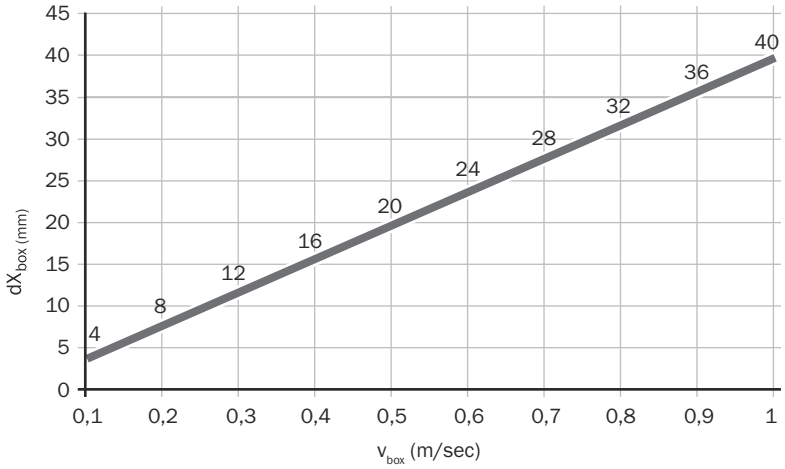



*Figure 28: Lateral object edge tolerance for a coded system*

The upper and lower object edge tolerance depends on the reduced resolution, see table 17, page 50.

*Table 17: Upper and lower object edge tolerance depends on the reduced resolution*

| Reduced resolution | Upper object edge tolerance | | Lower object edge tolerance |
|---|---|---|---|
| | Increasing object height of the passing object | Decreasing object height of the passing object | |
| Reduced resolution deactivated | At least 10 mm | At least 10 mm | At least 10 mm |
| 1 beam | At least 20 mm | At least 10 mm | At least 10 mm |
| 2 beams | At least 30 mm | At least 10 mm | At least 10 mm |

### Object speed

The object may move through the protective field at a speed of 0.1 m/s ... 1.0 m/s. At higher speeds, reliable human-material differentiation is not guaranteed.

### Object distance and object width

The objects are reliably detected if a minimum distance of 10 mm ... 100 mm is maintained between 2 consecutive objects and the objects have a minimum width of 10 mm ... 100 mm. The values depend on the object speed.

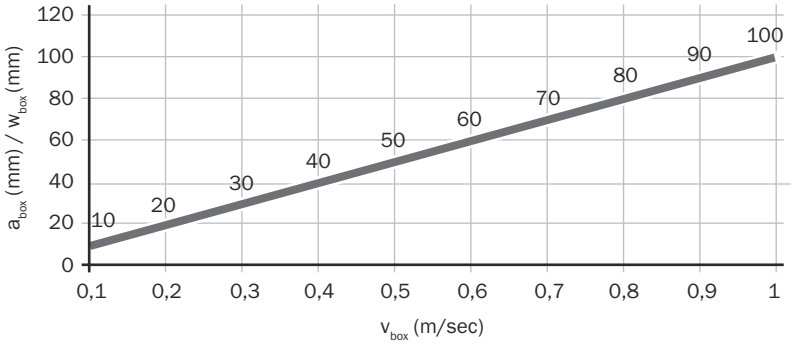



*Figure 29: Object distance and object width dependent on object speed*

### 4.3.7.2 Minimum distance to the hazardous point with Smart Box Detection

#### Overview

The calculation of the minimum distance to the hazardous point with configured Smart Box Detection depends on the application type.

**Application type 1:**

- Object exit [2]: Regardless of whether people on the transport level can be ruled out.
- Object entry [3] : People can be ruled out at the transport level.

**Application type 2:**

- Object entry [3]: People cannot be ruled out at the transport level.

#### Calculation of the minimum distance to the hazardous point

**The following formulas are available for calculating the minimum distance, depending on the application:**

- Application type 1:
  $S = (t_1 + t_2) * K + Z_{SBD}$
- Application type 2:
  $S = (t_1 + t_2) * (v_{box} + K) + Z_{SBD}$

**Where:**

- S = minimum distance in millimeters (mm)
- $t_1$ = response time of the protective device in seconds (s)
  The response time is 0.08 s (independent of the protective field height and beam coding).
- $t_2$ = machine stopping time in seconds (s)
  The machine stopping time is to be determined individually, e.g. 0.1 s
- $v_{box}$ = object speed (mm/s), 100 mm/s ... 1,000 mm/s
- K = approach speed (stepping and/or gripping speed) of a person or a body part (mm/s (see ISO 13855), e.g. 2,000 mm/s
- $Z_{SBD}$ = supplement for reliably distinguishing between a valid object and a person or body part in millimeters (mm), see table 18.

#### Supplement $Z_{SBD}$

Supplement $Z_{SBD}$ indicates how far a person or body part can approach the hazardous area before the protective device is triggered.

The value depends on the application type and the reduced resolution.

2) Objects on the transport level move out of the hazardous area.
3) Objects on the transport level move into the hazardous area.

*Table 18: Supplement $Z_{SBD}$*

| Application type | Reduced resolution | $Z_{SBD}$ |
|---|---|---|
| 1 | Deactivated | 128 mm |
| 1 | 1 beam | 208 mm |
| 1 | 2 beams | 850 mm |
| 2 | Deactivated (not allowed) | 236 mm |

**Calculation example: Application type 1**

The example shows the calculation of the minimum distance for application type 1 (e.g. object entry, people are ruled out on the transport level) when the reduced resolution is deactivated.

- Response time: 0.08 s
- Machine stopping time: 0,1 s
- Approach speed: 2,000 mm/s
- Reduced resolution deactivated

$S = (t_1 + t_2) * K + Z_{SBD}$

$S = (0.08\ s + 0.1\ s) * 2{,}000\ mm/s + 128\ mm$

$S = 488\ mm$

### 4.3.7.3 Effective resolution with Smart Box Detection

If Smart Box Detection is configured on a single system and the protective field is free of objects, the protective device has an effective resolution of 14 mm (reduced resolution deactivated).

As soon as the protective device detects a valid object, the detection capability of the free protective field area changes. The detection capability of the protective field area not covered by an object depends on the configured reduced resolution.

**NOTE**
Configuration of reduced resolution is only permitted in the framework of application type 1 [4].

*Table 19: Effective resolution with Smart Box Detection in combination with reduced resolution*

| Reduced resolution | Effective resolution with free protective field | Effective resolution above a valid object |
|---|---|---|
| Reduced resolution deactivated | 14 mm | 30 mm |
| 1 beam | 24 mm | 40 mm |
| 2 beams | 34 mm | 50 mm |

### 4.3.7.4 Smart Box Detection Override

**Overview**

Smart Box Detection Override enables manual override of the protective device after an invalid object has been detected by the protective device. The system can be released or an error-free state can be achieved.

Smart Box Detection Override is always active if Smart Box Detection has been configured.

4) Object exit (regardless of whether people can be ruled out on the transport level) or object entry (people can be ruled out on the transport level)

### Important information

**DANGER**

During Smart Box Detection Override, the protective field is not monitored.

Persons or body parts to be protected may not be detected.

► Prevent access to the hazardous area during execution of Smart Box Detection Override.

**NOTE**

If automatic measurement of the protective field width is configured and the protective field is interrupted when the ESPE is switched on for the first time, the system changes to the override condition if the override conditions are fulfilled. If override is performed, the OSSDs change to the OFF state again after the protective field frees up again, if necessary, until the protective field width is automatically measured.

Configure a dynamic protective field width to bypass this behavior.

### Prerequisites

- The Smart Box Detection Override control switch is mounted outside of the hazardous area so that it cannot be actuated by a person that is inside the hazardous area.
- The operator can oversee the entire hazardous area when actuating the control switch.

### Performing Smart Box Detection Override

When a Smart Box Detection condition is violated, the OSSDs switch to the OFF state.

**The Smart Box Detection Override required state is triggered by the system only when the following conditions apply:**

- The protective field is interrupted and the beam status of the protective field remains the same for 5 s.
- The top light beam is not interrupted.
- The integrated laser alignment aid of the sender is switched off.

If the conditions apply, the system changes to the Smart Box Detection Override required state. The cause of the error is indicated by the LEDs on the receiver. If an optional signal lamp is connected, this signal lamp also flashes.

To remove an object from the protective field, you can trigger the integrated Smart Box Detection Override function via the control switch. This causes the output signal switching devices (OSSDs) to switch to the ON state. Alternatively, you can eliminate the cause in another way, e.g. clearing the belt.

As soon as the protective field is free, Smart Box Detection Override is terminated.

### Monitoring override states

The number of Smart Box Detection Override states is limited to 5. The system automatically resets the counter each time the system is switched on and after every error-free cycle without an override.

If the permitted number of Smart Box Detection Override states has been exceeded, the system then switches to the locking state and displays an error message.

### Complementary information

If reset and Smart Box Detection Override are configured on the same input, both functions are started using a common control switch.

#### 4.3.7.5 Total time for Smart Box Detection

The total time limits the maximum duration for Smart Box Detection to 24 hours, i.e. Smart Box Detection is terminated at the latest when the total time has expired. The system then changes to the Smart Box Detection Override required state.

The total time for Smart Box Detection is always active.

## 4.4 Integration in electrical control

### Overview

This chapter contains important information about integration in the electrical control. Information about the individual steps for electrical installation of the device: see "Electrical installation", page 86.

### Important information

**DANGER**

Hazard due to lack of effectiveness of the protective device

In the case of non-compliance, it is possible that the dangerous state of the machine may not be stopped or not stopped in a timely manner.

► Make sure that the following control and electrical requirements are met so that the product can fulfill its protective function.

### Requirements for use

The output signals of the protective device must be analyzed by downstream controllers in such a way that the dangerous state of the machine is ended safely. Depending on the safety concept, signal evaluation is carried out e.g. with safety relays or with a safety controller.

- It must be possible to electrically influence the control of the machine
- The electrical control of the machine must meet the requirements of IEC 60204-1
- When using a safety controller, different signal levels of both OSSDs must be detected depending on applicable national regulations or required reliability of the safety function. The maximum discrepancy time tolerated by the controller must be selected according to the application.
- The OSSD1 and OSSD2 output signals must not be connected to each other
- In the machine controller, the signals of both OSSDs must be processed separately

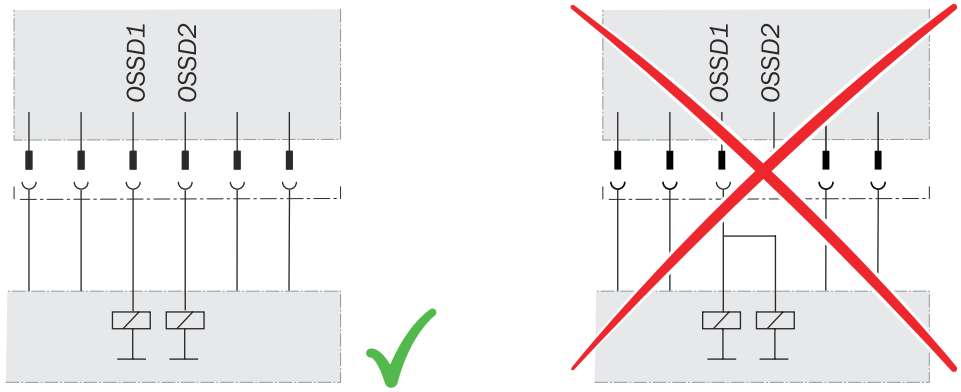



*Figure 30: Dual-channel and isolated connection of OSSD1 and OSSD2*

- The machine must switch to the safe state at any time if at least one of the two OSSDs switches to the OFF state
- Prevent the formation of a potential difference between the load and the protective device. If you connect loads to the OSSDs (switch outputs) that then also switch if controlled with negative voltage (e.g., electro-mechanical contactor without reverse polarity protection diode), you must connect the 0 V connections of these loads and those of the corresponding protective device individually and directly to the same 0 V terminal strip. In the event of a fault, this is the only way to ensure that there can be no potential difference between the 0 V connections of the loads and those of the corresponding protective device.

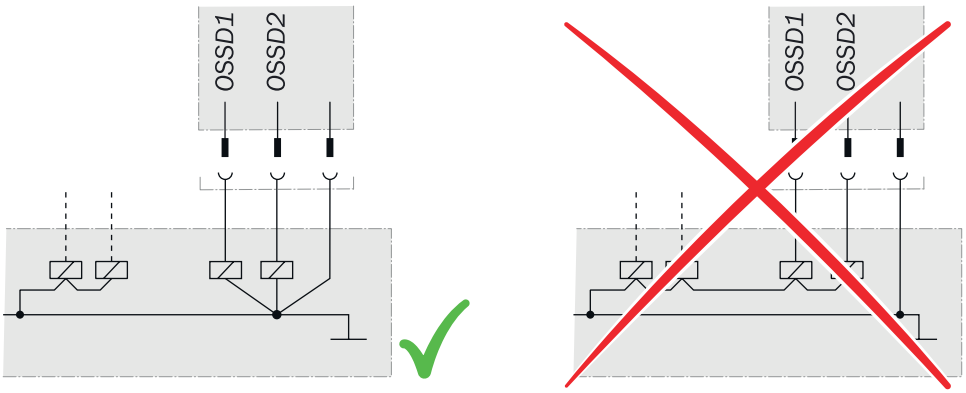



*Figure 31: No potential difference between load and protective device*

**DANGER**
Hazard due to lack of effectiveness of the protective device

In the case of non-compliance, it is possible that the dangerous state of the machine may not be stopped or not stopped in a timely manner.

Downstream contactors must be positively guided and monitored depending on applicable national regulations or required reliability of the safety function.

► Make sure that downstream contactors are monitored (external device monitoring, EDM).

**DANGER**
Hazard due to unexpected starting of the machine

A restart interlock must be implemented depending on applicable national regulations or required reliability of the safety function.

► Make sure that a restart interlock is implemented.

**Requirements for the electrical control of the machine**

Both outputs are short-circuit protected to 24 V DC and 0 V. When the protective field is clear, the OSSDs are in the ON state. When a switch-off condition is present (e.g., interruption in the light path), the OSSDs are in the OFF state. In the event of a device fault, at least one OSSD is in the OFF state.

The protective device complies with the rules for electromagnetic compatibility (EMC) for the industrial sector (Radio Safety Class A).

**NOTE**
Using the device in residential areas may cause radio interference. The operating entity is responsible for taking appropriate measures (e.g., shielding).

The following requirements are met:

- The external voltage supply of the protective device must be capable of buffering brief power failures of 20 ms as specified in IEC 60204-1.
- The power supply unit must ensure safe isolation according to IEC 61140 (SELV/PELV). Suitable power supply units are available as accessories from SICK.

**Further topics**

- "Accessories", page 153

### 4.4.1 Restart interlock

**Overview**

The restart interlock prevents the machine from automatically starting up, for example after a protective device has responded while the machine is operating or after changing the machine's operating mode.

Depending on the regulations which apply at the place of installation, a restart interlock may be required.

The safety light curtain has an internal restart interlock.

**Important information**

**DANGER**
Hazard due to unexpected starting of the machine

The machine may not restart if the OSSDs switch to the ON state once the reset pushbutton has been pressed. The control must ensure that the machine only restarts if the machine start button is also pressed after the reset pushbutton.

► Make sure that the machine can only restart once the reset pushbutton and start button have been pressed in the specified order.

**Principle of operation**

Before the machine can be restarted, the operator must reset the restart interlock.

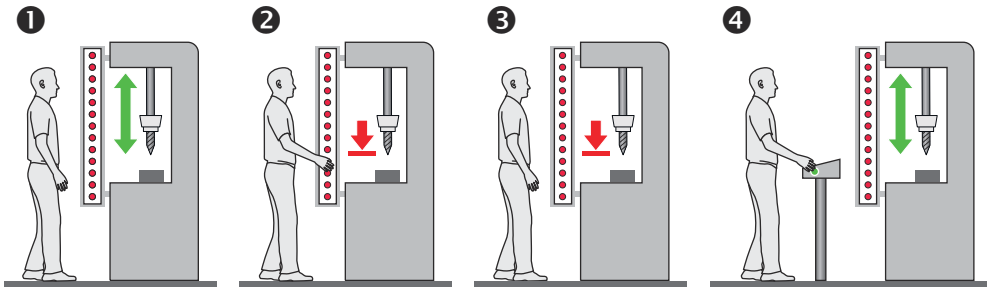



*Figure 32: Schematic representation of operation with restart interlock*

The dangerous state of the machine (❶) is brought to an end if the light path is interrupted (❷) and is not re-enabled (❸) until the operator presses the reset pushbutton located outside the hazardous area (❹). The machine can then be restarted.

Depending on applicable national regulations, a restart interlock must be available if it is possible to stand behind the protective device. Observe IEC 60204-1.

#### 4.4.1.1 Integrated restart interlock and reset

**Prerequisites**

- A reset device, such as a reset pushbutton, is connected.

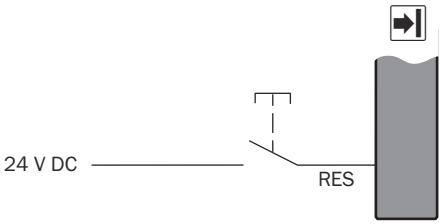



*Figure 33: Electrical diagram of the reset device*

#### Using an integrated restart interlock

The restart interlock is configured once the reset pushbutton has been connected.

When the restart interlock is configured, the application diagnostic output located on the same plug connector as the reset pushbutton signals when the reset pushbutton needs to be pressed.

**The following applies to the restart interlock:**

- If the protective field is clear once the machine has been switched on or following an interruption, the OSSDs do not switch to the ON state
- If someone presses the reset pushbutton and then lets go of it when the protective field is clear, the OSSDs switch to the ON state
- The machine may not restart yet. The operator must also press the machine start button after having pressed the reset pushbutton.

#### Single system

Only one reset pushbutton may be connected to a single safety light curtain.

**Connection options of the reset pushbutton in the single system:**

- M12, 8-pin system connection
- Extension connection on the receiver

#### Cascade

A total of just one reset pushbutton may be connected to a cascade comprising two or three safety light curtains.

**Connection options of the reset pushbutton in a cascade:**

- M12 system connection, 8-pin at the receiver of the host device
- Extension connection at the last receiver of the guest device

#### Further topics

- "Configuring the restart interlock", page 103

### 4.4.2 External device monitoring (EDM)

#### Overview

The safety light curtain has internal external device monitoring.

The external switching elements (external device monitoring, EDM) must be inspected in line with the regulations which apply at the place of installation or the required reliability of the safety function.

External device monitoring (EDM) monitors the status of downstream contactors.

#### Prerequisites

- Positively guided contactors are used for shutting down the machine.

#### Principle of operation

If you configure external device monitoring, the safety light curtain then checks the contactors after every interruption to the light path and before the machine restarts. External device monitoring is then able to detect if one of the contactor's contacts is welded, for instance. In this case, the OSSDs remain in the OFF state.

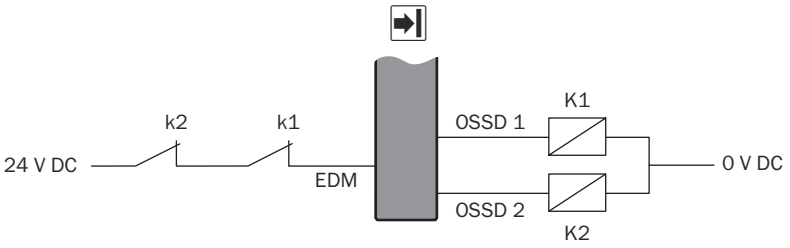



*Figure 34: Electrical diagram of external device monitoring (EDM)*

You must implement external device monitoring electrically so that the two N/Cs (k1, k2) close in a positively guided manner when the contactors (K1, K2) reach their de-energized position once the protective device has responded. 24 V are then present at the input of external device monitoring. If 24 V are not present once the protective device has responded, one of the contactors is defective and external device monitoring prevents the machine from restarting.

### 4.4.3 Application diagnostic output

The safety light curtain has an application diagnostic output on the system connection and on the extension connection.

Depending on the configuration, the application diagnostic output signals a certain status of the safety light curtain, e.g. if the reset pushbutton must be engaged or if there is a weak signal at the receiver.

For a signal of the safety light curtain to be displayed, a light can be connected to the application diagnostic output or the signal can be transmitted to the machine controller.

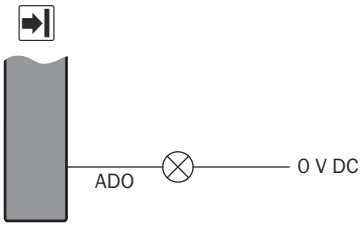



*Figure 35: Electrical diagram of the application diagnostic output*

#### Further topics

- "Configuring application diagnostic output", page 105

### 4.4.4 Signal lamp

#### Overview

You can attach an external signal lamp to the system to indicate muting or Smart Box Detection.

During operation, the signal lamp indicates temporary muting or the detection of a valid object by Smart Box Detection.

#### Prerequisites

- The signal lamp must be visible from all sides of the hazardous area and visible to the operator of the system.

#### Complementary information

You can optionally use a receiver with an integrated LED. The integrated LED is located in the end cap of the receiver.

### 4.4.5 Connection of sender and receiver

#### Overview

To indicate the status on both sides, you can connect the sender and receiver to each other in the control cabinet. To do this, connect the following wires:

- 0 V DC of sender and receiver
- +24 V DC of sender and receiver
- MFP1 of sender and receiver

#### Prerequisites

- The type codes of the sender and receiver must be identical at the following place in the number sequence.
  - Variant 1: C4P-******0***
  - Variant 2: C4P-******1***
- If the type codes at this place in the number sequence differ, the connection between the sender and receiver must be disconnected.

#### Connection via a T-connector

Alternatively, you can connect the sender and receiver to each other via a T-connector (with an optional pushbutton for the laser alignment aid). In such cases, you only require a cable to the control cabinet and the status will also be indicated on both sides. Please note that the sender and receiver are protected jointly by one fuse when a T-connector is used. In the T-connector, all contacts are routed from the female connector to the same pins of both male connectors.

The T-connector must only be connected to the system connection of an individual device or a host device.

**The OSSD status and the status of the protective field are indicated via LEDs on the sender and receiver when the following applies:**

- The sender and receiver are connected to one another in the control cabinet
- The sender and receiver are connected to one another via a T-connector

If the sender and receiver are not connected to each other, this status information is only indicated at the receiver.

Even if you do not use a T-connector, you can connect the sender and receiver with identical cables. The advantage of this is that the sender and receiver can be switched without changing the cables if the installation situation so requires, e.g., to prevent mutual interference between systems in close proximity to each other.

#### Further topics

- "Accessories", page 153
- "Protection against interference from systems in close proximity to each other", page 33

### 4.4.6 Laser alignment aid

#### Important information

**DANGER**
Hazard due to lack of effectiveness of the protective device

The integrated laser alignment aid switches the OSSDs to the OFF state.

- ► Make sure that the outputs of the safety light curtain do not have any effect on the machine when the integrated laser alignment aid is activated.
- ► Only use the integrated laser alignment aid to align the safety light curtain.

#### Prerequisites

- A pushbutton is connected.
- A T-connector with pushbutton is connected.
- A switch is connected.

#### Pushbutton

The pushbutton is mounted at the system connection of the sender between the system plug and the connecting cable.

The pushbutton can be temporarily mounted for alignments or used to maintain a permanent connection.

**Functionality of the pushbutton**

- Press the pushbutton once and release: integrated laser alignment aid is switched on
- Press the pushbutton again and release: integrated laser alignment aid is switched off

#### Switch

The switch is not suitable for safety light curtains where the sender and receiver are connected via a T-connector.

The switch is mounted in the control cabinet. A relay or a PLC can also be used as a switch to enable the integrated laser alignment aid to be switched on and off via a control panel, for example.

The switch must be connected in accordance with the circuit diagram below.

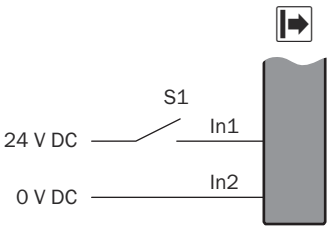



*Figure 36: Switch for the integrated laser alignment aid*

- S1 closed: integrated laser alignment aid is switched on
- S1 open: integrated laser alignment aid is switched off

#### IO-Link

If the sender and receiver are connected with each other, the laser alignment aid can also be activated by a command from IO-Link.

### Further topics

- "Connection of sender and receiver", page 59
- "IO-Link", page 64
- "Accessories", page 153

## 4.4.7 Cascading

### Important information

**DANGER**

Hazard due to lack of effectiveness of the protective device

If 2 or more identical safety light curtains (same resolution and same protective field height) are used in a cascade, the protective device can be disabled if the connecting cables are switched round.

► Make sure (e.g., by routing the cables appropriately) that the operator is unable to switch round the connecting cables of 2 senders or receivers of the same type.

### Prerequisites

- The type codes of the connected sender devices are identical at the following place in the number sequence.
  - Variant 1: C4P-******0***
  - Variant 2: C4P-******1***
- The type codes of the connected receiver devices are identical at the following place in the number sequence.
  - Variant 1: C4P-******0***
  - Variant 2: C4P-******1***
- The type codes of the sender devices may differ from the receiver devices at this place in the number sequence if the sender and receiver devices are not connected with each other.

### Integrating safety light curtains in a cascade

You can use cascading to connect up to 3 safety light curtains, e. g., to provide reliable presence detection. The connected devices act like a long safety light curtain. Only one device, the host, is connected to the control cabinet. The second device, guest 1, is connected to the host. The third device, guest 2, is connected to guest 1.

Advantages of cascading:

- Rapid connection, no additional external circuitry required
- No optical mutual interference between the protective fields within a cascade. Host and guests are operated with the same beam coding.
- Resolution and protective field heights of the individual systems may be different

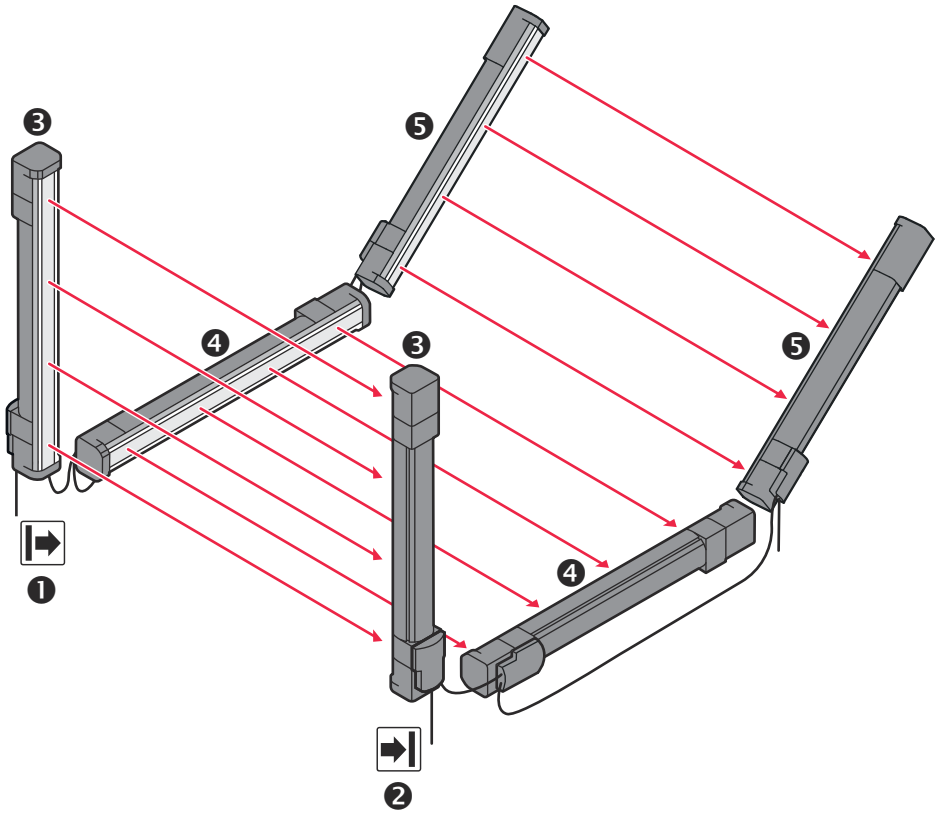



*Figure 37: Cascade*

❶ Sender
❷ Receiver
❸ Host
❹ Guest 1
❺ Guest 2

### Use of system plugs in a cascade

*Table 20: Use of system plugs in a cascade*

| | | SP1 system plug type code | | | SP2 system plug type code | |
|---|---|---|---|---|---|---|
| | | 1000  | 1100  | 1300  | 2100  | 2300  |
| Host | Sender | – | ✓ | ✓ [1] | – | – |
| | Receiver | – | ✓<br>**Functions at the host**<br>• Beam coding | ✓<br>**Functions at the host**<br>• Beam coding<br>• Restart interlock<br>• External device monitoring<br>• Application diagnostic output | ✓<br>**Functions at the host**<br>• Beam coding<br>• Reduced resolution<br>• Dynamic protective field width<br>• Smart presence detection | ✓<br>**Functions at the host**<br>• Beam coding<br>• Reduced resolution<br>• Dynamic protective field width<br>• Restart interlock<br>• External device monitoring<br>• Application diagnostic output<br>• Smart presence detection |
| First guest (for cascade with 2 guest devices) | Sender | – | ✓ | – | – | – |
| | Receiver | – | ✓ | – | – | – |
| Last guest | Sender | ✓ | ✓ [2] | – | – | – |
| | Receiver | ✓ | ✓<br>**Functions at the last guest**<br>• External device monitoring<br>• Restart interlock<br>• Application diagnostic output<br>• IO-Link | – | – | – |

✓ System plug suitable.

– System plug not suitable. An SP1 system plug must be used on the receiver of a guest system as well as on the sender of a host system and guest system.

1) At the sender, the 8-pin system connection is solely for the purposes of providing standardized wiring. It is particularly recommended if the 8-pin system connection at the receiver is used and the sender and receiver are connected to each other via a T-connector.

2) If a sender does not have an additional guest connected to it, the extension connection has no function and must be sealed with a protective cap.

### Complementary information

Information regarding the maximum number of beams in a cascade can be found at Data sheet, page 140.

### 4.4.8 Smart presence detection

#### Overview

The safety light curtain features smart presence detection for access and hazardous area protection. The function can be configured during commissioning.

#### Principle of operation

Smart presence detection is implemented using a cascade. The guest system is only active if the protective field of the host system has been interrupted. The OSSDs then change to the OFF status and the machine is stopped. As long as the protective field of the host or guest system is interrupted, machine start-up is not possible.

If all of the protective fields have been clear for at least 0.5 s, the OSSDs change back to the ON state and the guest system returns to sleep mode.

Smart presence detection prevents an unintentional machine shut-off, for example if chips fall into the hazardous area protected by the guest systems.

### 4.4.9 IO-Link

#### Overview

The IO-Link connector is used to establish a connection between suitable devices and an IO-Link master, enabling communication via IO-Link.

The IO-Link connector can also be used to connect 2 muting sensors.

**The following information can be output via IO-link:**

- Application diagnostic output status information
- Device information and device status
- Configuration of the device
- Status of each individual light beam
- Error history
- Reasons for the last lockout

**The following information can be controlled via IO-link:**

- LED signal behavior of the field indicator
- LED light behavior of the integrated indicator lamp on the receiver (optional)
- Switching on and off of the integrated laser alignment aid

#### Complementary information

Detailed information on how the IO-Link connector is connected can be found in the assembly instructions for the IO-Link connector.

### 4.4.10 Muting

#### Overview

Muting temporarily bypasses the protective action of the safety light curtain so that material can be transported to or from a machine or system.

To use muting, muting sensors must be connected to the device.

**Connection options:**

- Muting sensor signals are at the extension connection
  The muting sensors must be arranged with an offset so that the signals arrive at the device at different times.
- Muting sensor signals are distributed on the system and extension connections
  The muting sensors do not have to be arranged with an offset.
- The muting sensors are connected to a muting connector
  The muting connector makes it possible to connect 2 muting sensors and one muting lamp. The muting sensors do not have to be arranged with an offset.

**Complementary information**

Override is connected to the 8-pin system connection.

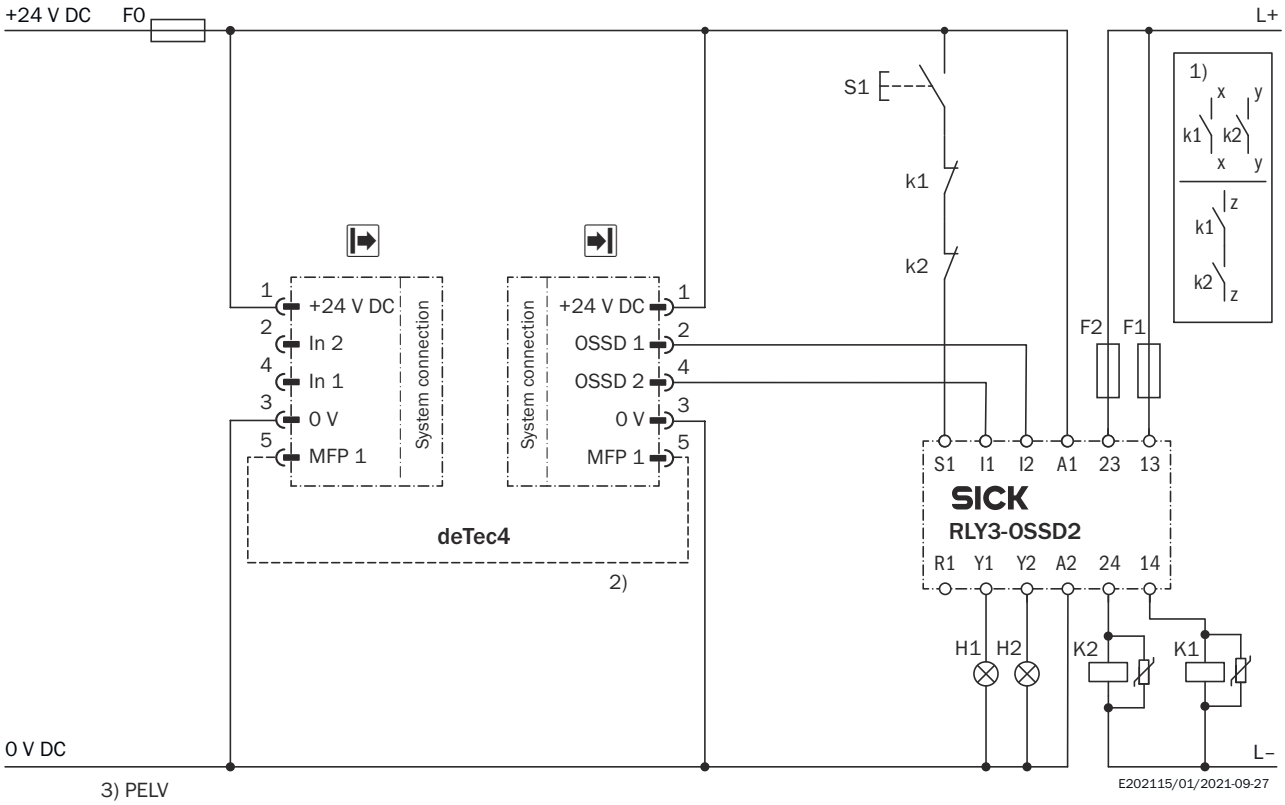
Detailed information on using the muting connector can be found in the assembly instructions for the muting connector.

**Further topics**

- "Cross-circuit monitoring", page 46
- "Electrical installation", page 86
- "Accessories", page 153

### 4.4.11 Connection diagrams

**5-pin, RLY3-OSSD2 safety relay**




**1)** Output circuits: These contacts must be incorporated into the control such that the dangerous state is brought to an end if the output circuit is open. For categories 4 and 3, they must be incorporated on dual-channels (x, y paths). Type 2 devices are suitable for use up to PL c. Single-channel incorporation into the control (z path) is only possible with a single-channel control and taking the risk analysis into account.

**2)** To indicate the status on both sides, the MFP 1 connections from the sender and receiver must be connected to each other in the control cabinet (optional).

**3)** SELV/PELV safety extra-low voltage.

- **Task**
  Connection of a deTec4 safety light curtain to a RLY3-OSSD2 safety relay. Operating mode: With restart interlock and external device monitoring.
- **Mode of operation**
  When the protective field is clear, the OSSD 1 and OSSD 2 outputs carry voltage. The system can be switched on when K1 and K2 are in a fault-free de-energized position. Lamp H2 flashes. The RLY3-OSSD2 is switched on by pressing S1 (push-button is pressed and released). The outputs (contacts 13-14 and 23-24) switch

the K1 and K2 contactors on. When the protective field is interrupted, the OSSD 1 and OSSD 2 outputs switch the RLY3-OSSD2 off. Lamp H1 lights up. Contactors K1 and K2 are switched off. As soon as the protective field is clear again, lamp H2 flashes.

- **Fault analysis**
  Cross-circuits and short-circuits of the OSSDs are recognized and lead to the locking status (lock-out). A malfunction with one of the K1 or K2 contactors is detected. The switch-off function is retained. In the event of manipulation (e.g., jamming) of the S1 pushbutton, the RLY3-OSSD2 will not re-enable the output current circuits.

**8-pin, RLY3-OSSD1 safety relay**

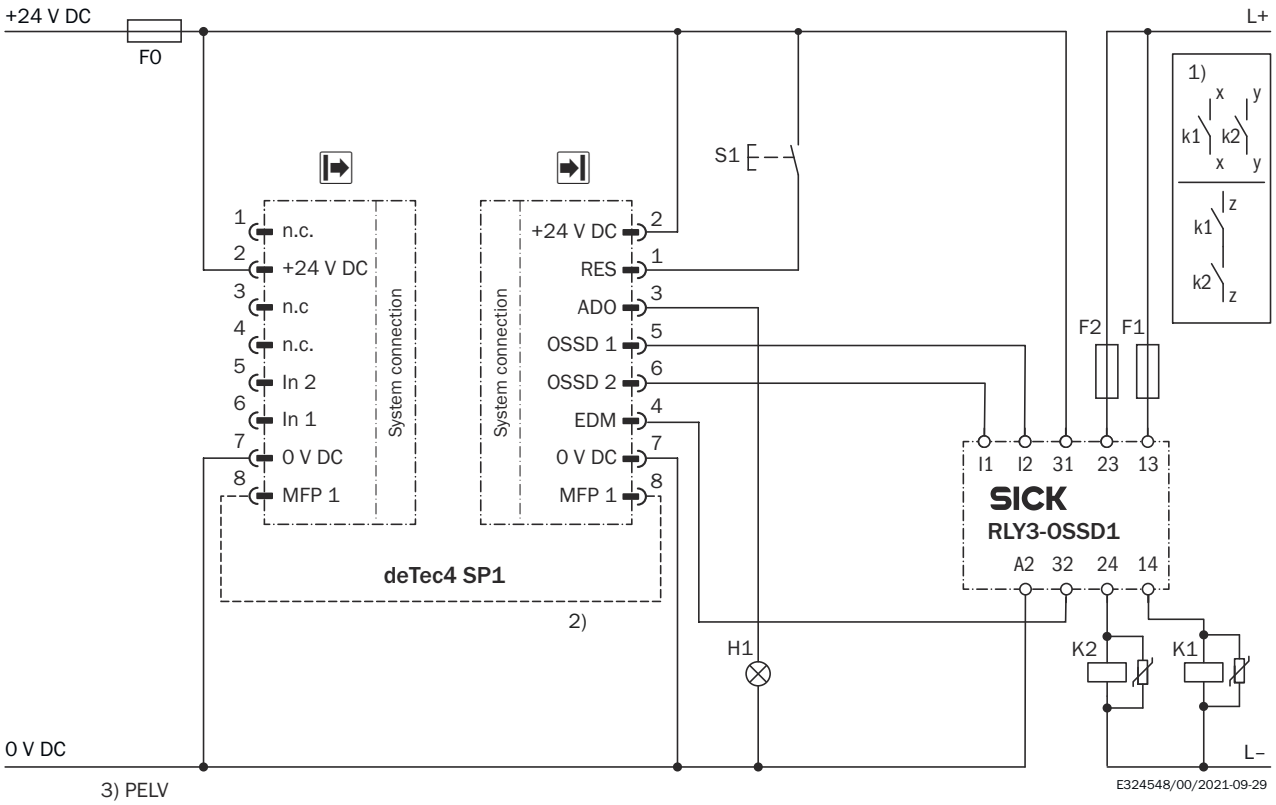



*Figure 38: Connection diagram: 8-pin, RLY3-OSSD1 safety relay*

**1)** Output circuits. These contacts must be incorporated into the control such that the dangerous state is brought to an end if the output circuit is open. For categories 4 and 3, they must be incorporated on two channels (x, y paths). Single-channel incorporation into the control (z path) is only possible with a single-channel control and taking the risk analysis into account.

**2)** To indicate the status on both sides, the MFP 1 connections from the sender and receiver must be connected to each other in the control cabinet (optional).

**3)** SELV/PELV safety extra-low voltage.

- **Task**
  Connection of a deTec4 safety light curtain to a RLY3-OSSD1 safety relay. Operating mode: With restart interlock, external device monitoring (EDM), and application diagnostic output.
- **Mode of operation**
  If the protective field is clear and the RLY3-OSSD1 is in a fault-free de-energized position, the field indicator and the H2 lamp flash. The system can be switched on. The system is enabled by pressing S1 (pushbutton is pressed and released).

Outputs OSSD 1 and OSSD 2 carry voltage, the RLY3-OSSD1 is switched on. When the protective field is interrupted, the OSSD 1 and OSSD 2 outputs switch the RLY3-OSSD1 off.

- **Fault analysis**
  Cross-circuits and short-circuits of the OSSDs are recognized and lead to the locking state (lock-out). The malfunction of the RLY3-OSSD1 is detected. The shut-down function is retained. Manipulation (e.g., jamming) of the S1 pushbutton prevents the output current circuits from being enabled.

**T-connector, RLY3-OSSD2 safety relay, with restart interlock and external device monitoring (EDM)**

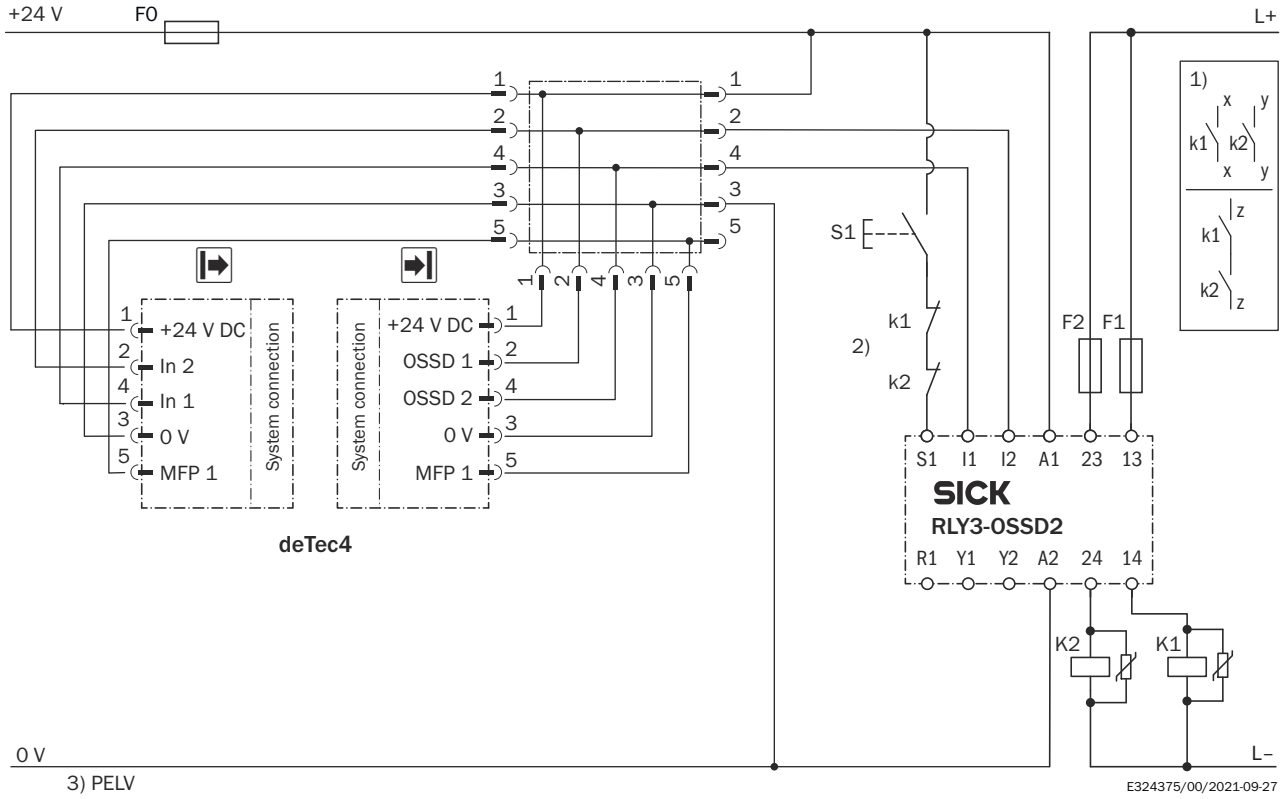



*Figure 39: Connection diagram: 5-pin, T-connector, RLY3-OSSD2, with restart interlock and external device monitoring (EDM)*

**1)** Output circuits. These contacts must be incorporated into the control such that the dangerous state is brought to an end if the output circuit is open. For categories 4 and 3, they must be incorporated on two channels (x, y paths). Single-channel incorporation into the control (z path) is only possible with a single-channel control and taking the risk analysis into account.

**2)** External device monitoring is only static.

**3)** SELV/PELV safety extra-low voltage.

- **Task**
  Connection of a deTec4 safety light curtain to a RLY3-OSSD2 safety relay. Operating mode: With restart interlock and external device monitoring (EDM). The T-connector establishes a connection between the sender and the receiver.
- **Mode of operation**
  When the protective field is clear, the OSSD 1 and OSSD 2 outputs carry voltage. The system can be switched on when K1 and K2 are in a fault-free de-energized position. The RLY3-OSSD2 is switched on by pressing S1 (pushbutton is pressed

and released). The outputs (contacts 13-14 and 23-24) switch the K1 and K2 contactors on. When the protective field is interrupted, the OSSD 1 and OSSD 2 outputs switch the RLY3-OSSD2 off. Contactors K1 and K2 are switched off.

- **Fault analysis**
  Cross-circuits and short-circuits of the OSSD 1 and OSSD 2 outputs are recognized and lead to the locking state (lock-out). A malfunction with one of the K1 or K2 contactors is detected. The shut-down function is retained. In the event of manipulation (e.g., jamming) of the S1 pushbutton, the RLY3-OSSD2 will not re-enable the output current circuits.

**Cascade, 8-pin host, 5-pin guest, RLY3-OSSD1 safety relay**

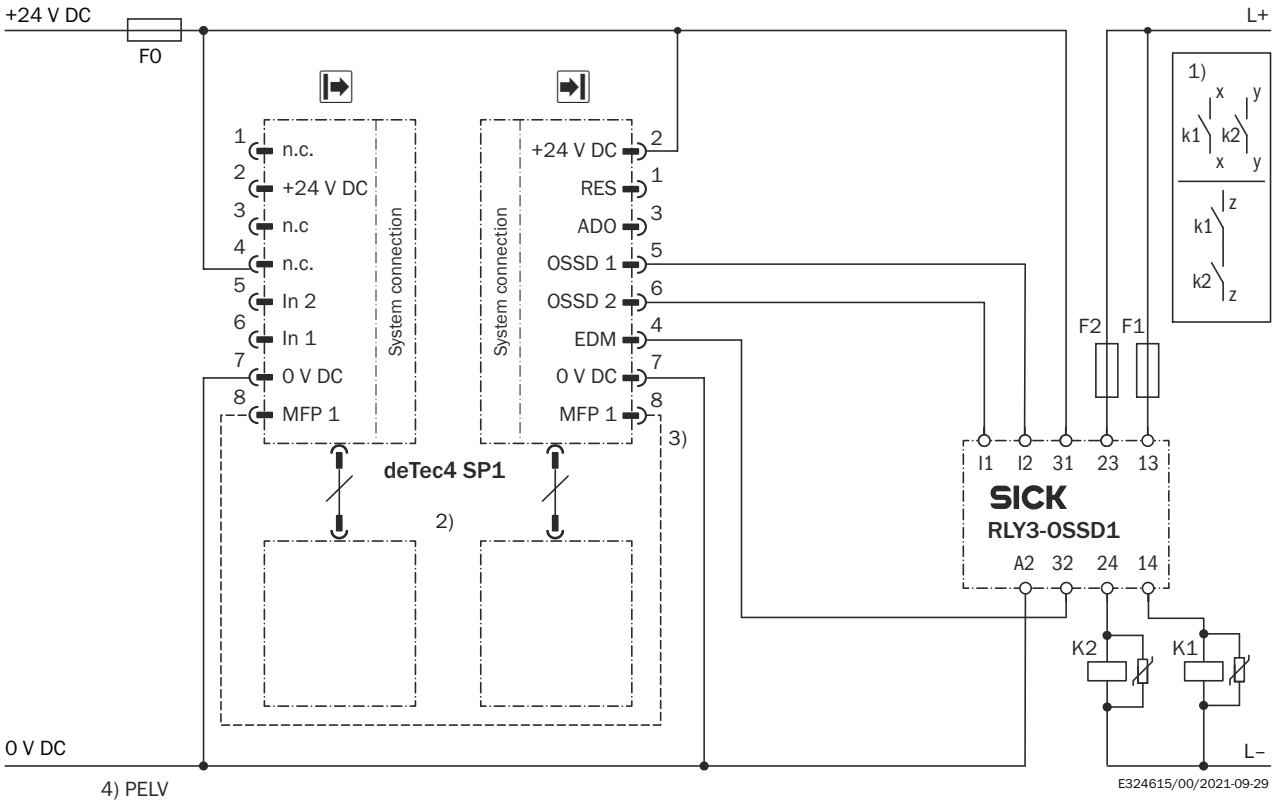



*Figure 40: Connection diagram: Cascade, 8-pin host, 5-pin guest, RLY3-OSSD1*

**1)** Output circuits. These contacts must be incorporated into the control such that the dangerous state is brought to an end if the output circuit is open. For categories 4 and 3, they must be incorporated on two channels (x, y paths). Single-channel incorporation into the control (z path) is only possible with a single-channel control and taking the risk analysis into account.

**2)** Connection of the 5-pin extension connection of the host device to the 5-pin system connection of the guest device.

**3)** To indicate the status on both sides, the MFP 1 connections from the sender and receiver must be connected to each other in the control cabinet (optional).

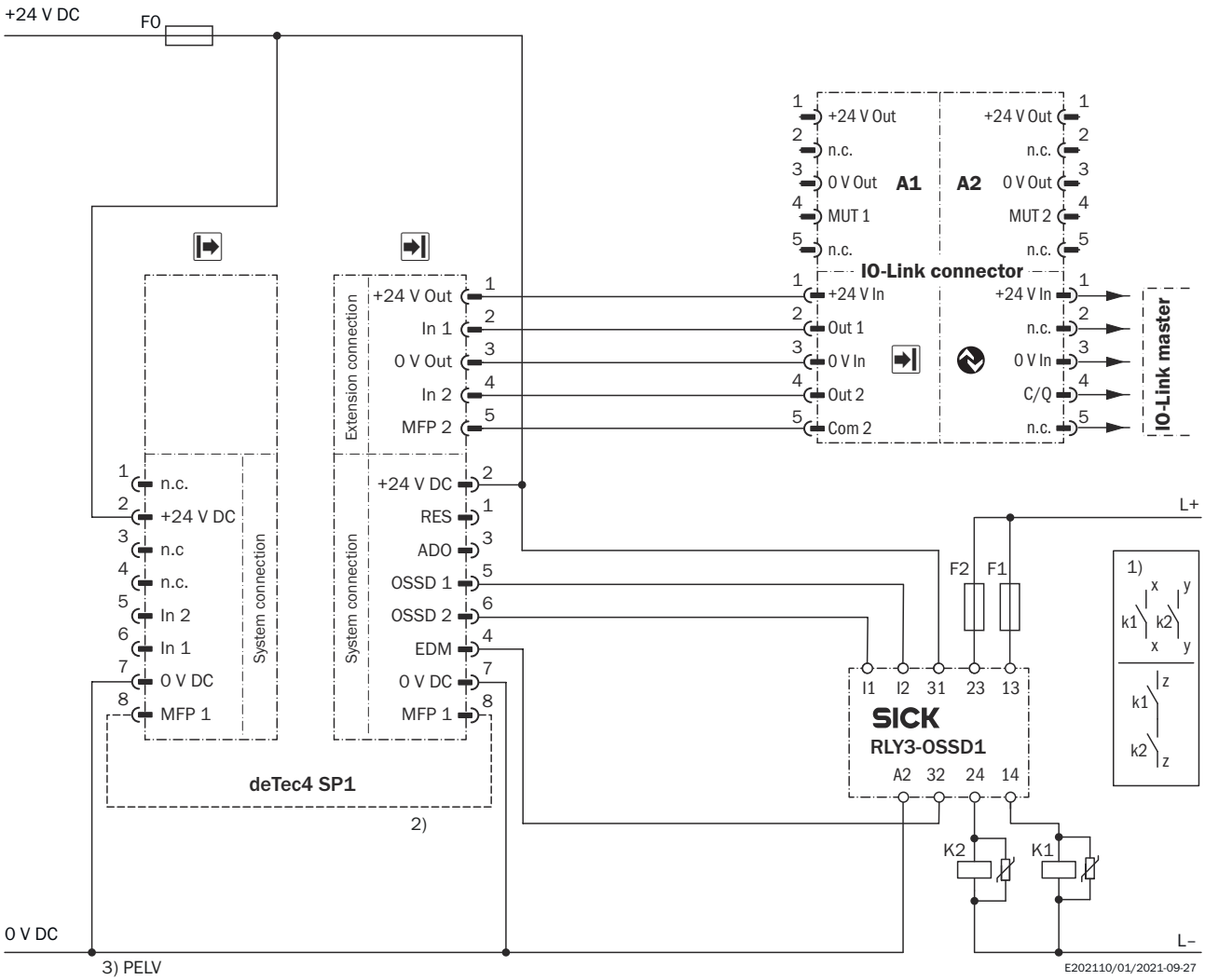
**4)** SELV/PELV safety extra-low voltage.

- **Task**
  Connection of two deTec4 safety light curtains to a RLY3-OSSD1 safety relay. Operating mode: Without restart interlock, with external device monitoring (EDM). If required, the restart interlock is implemented via the machine controller.
- **Mode of operation**

If the protective field is clear and the UE10-3OS is in a fault-free, de-energized position, the system is enabled. Outputs OSSD 1 and OSSD 2 carry voltage, the UE10-3OS is switched on. When the protective field is interrupted, the OSSD 1 and OSSD 2 outputs switch the UE10-3OS off.

- **Fault analysis**
  Cross-circuits and short-circuits of the OSSDs are recognized and lead to the locking state (lock-out). The malfunction of the UE10-3OS is detected. The shut-down function is retained.

### IO-Link, RLY3-OSSD1 safety relay, with SP1 system plug




**1)** Output circuits: These contacts must be incorporated into the control such that the dangerous state is brought to an end if the output circuit is open. For categories 4 and 3, they must be incorporated on two channels (x, y paths). Type 2 devices are suitable for use up to PL c. Single-channel incorporation into the control (z path) is only possible with a single-channel control and taking the risk analysis into account.

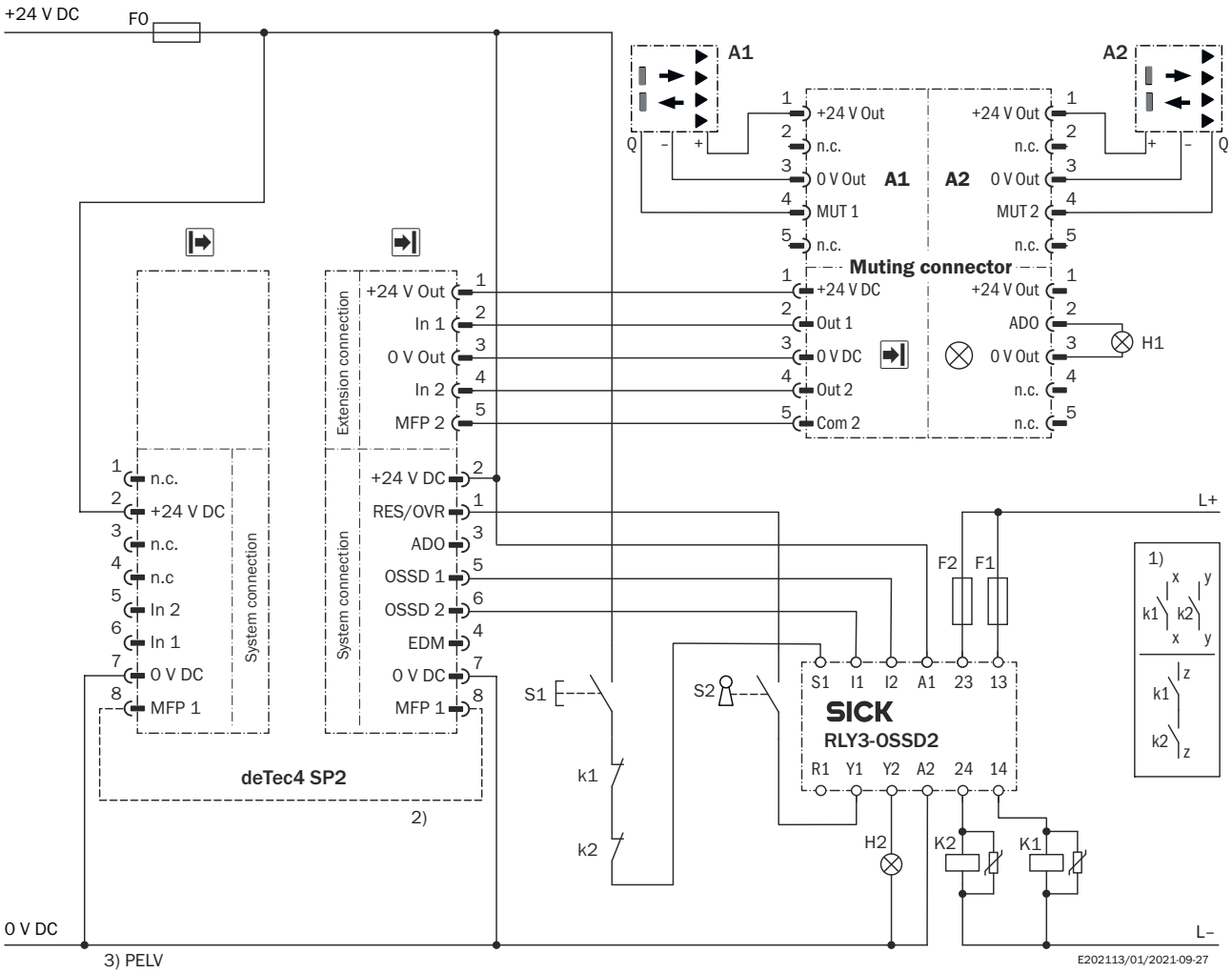
**2)** To indicate the status on both sides, the MFP 1 connections from the sender and receiver must be connected to each other in the control cabinet (optional).

**3)** SELV/PELV safety extra-low voltage.

- **Task**
  Connection of a deTec4 safety light curtain with an SP1 system plug to a RLY3-OSSD1 safety relay. Operating mode: Without restart interlock, with external device monitoring. IO-Link: Data output via IO-Link connector.

- **Mode of operation**
  If the protective field is clear and the RLY3-OSSD1 is in a fault-free, de-energized position, the system is enabled. Outputs OSSD 1 and OSSD 2 carry voltage, the RLY3-OSSD1 is switched on. The outputs (contacts 13-14 and 23-24) switch the K1 and K2 contactors on. When the protective field is interrupted, the OSSD 1 and OSSD 2 outputs switch the RLY3-OSSD1 off. Contactors K1 and K2 are switched off. Status and fault information, as well as diagnostics data, can be transferred directly to an IO-Link master via IO-Link connectors.
- **Fault analysis**
  Cross-circuits and short-circuits of the OSSDs are recognized and lead to the locking status (lock-out). A malfunction with one of the K1 or K2 contactors is detected. The switch-off function is retained.

### Muting, RLY3-OSSD2 safety relay, with SP2 system plug




**1)** Output circuits: These contacts must be incorporated into the control such that the dangerous state is brought to an end if the output circuit is open. For categories 4 and 3, they must be incorporated on dual-channels (x, y paths). Type 2 devices are suitable for use up to PL c. Single-channel incorporation into the control (z path) is only possible with a single-channel control and taking the risk analysis into account.

**2)** To indicate the status on both sides, the MFP 1 connections from the sender and receiver must be connected to each other in the control cabinet (optional).

**3)** SELV/PELV safety extra-low voltage.

- **Task**

Connection of a deTec4 safety light curtain with an SP2 system plug to a RLY3-OSSD2 safety relay. Muting with 2 photoelectric retro-reflective sensors (xxx-switching). Operating mode: With restart interlock and external device monitoring.

- **Mode of operation**
  When the protective field is clear, the OSSD 1 and OSSD 2 outputs carry voltage. The system can be switched on when K1 and K2 are in a fault-free de-energized position. Lamp H2 flashes. The RLY3-OSSD2 is switched on by pressing S1 (push-button is pressed and released). The outputs (contacts 13-14 and 23-24) switch the K1 and K2 contactors on. When the protective field is interrupted, the OSSD 1 and OSSD 2 outputs switch the RLY3-OSSD2 off. Contactors K1 and K2 are switched off.
- **Muting and override**
  Muting starts when the protective field is clear and valid muting input conditions apply. Muting lamp H1 signals the muting status. If a fault occurs when the protective field is interrupted and at least one muting sensor is active, the safety light curtain must be in the Override state. Pressing key-operated pushbutton S2 (pressing and releasing) initiates the Override state.

## 4.5 Testing plan

The manufacturer of the machine and the operating entity must define all required checks. The definition must be based on the application conditions and the risk assessment and must be documented in a traceable manner.

In addition, the device must be checked for correct functioning after each change to the configuration and each insertion of the system plug.

► When defining the check, please note the following:
  - Define the type and execution of the check.
  - Define the frequency of the check.
  - Notify the machine operators of the check and instruct them accordingly.

**The following checks are often defined in connection with a protective device:**

- Check during commissioning and modifications
- Regular thorough check

### Check during commissioning and modifications

Before commissioning the machine and after making changes, you must check whether the safety functions are fulfilling their planned purpose and whether persons are being adequately protected.

The thorough check is intended to ensure that the safety functions are fulfilling their planned purpose and whether persons are being adequately protected.

**The following points are often helpful for the definition of the check:**

- Does the check have to be completed by qualified safety personnel?
- Can the check be completed by specially qualified and authorized personnel?
- Does the check have to be documented in a traceable manner?
- Can the check be carried out according to a check list? (see "Checklist for initial commissioning and commissioning", page 167)
- Do the machine operators know the function of the protective device?
- Have the machine operators been trained to work on the machine?
- Have the machine operators been notified about modifications on the machine?
- Does the hazardous area being secured have to be checked with a test rod? (see "Test rod check", page 72)

► Define all guidelines for the check.

### Regular thorough check

The thorough check is intended to ensure that the safety functions are fulfilling their planned purpose and whether persons are being adequately protected.

**The following points are often helpful for the definition of the check:**

- Which check must be carried out and how is it carried out?
  - Test rod check, page 72
  - Visual check of the machine and the protective device, page 75
- How often does the check have to be carried out?
- Do the machine operators have to be notified of the check and do they need to be instructed accordingly?

► Define all guidelines for the check.

## 4.5.1 Test rod check

### Overview

The rod test check is used to check whether the hazardous point is only accessible via the protective field of the safety light curtain and whether the protective device is able to identify each time the hazardous point is approached.

The test is carried out with an opaque test rod whose diameter corresponds to the resolution of the safety light curtain.

If several safety light curtains are connected to each other in a cascade, the complete check for every safety light curtain in the cascade is carried out. During the check, catch the field indicator of the device you are currently testing.

### Important information

**DANGER**
Use of incorrect test rods

Persons or parts of the body to be protected may not be detected in operation.

► Only use the test rod with the diameter specified on the type label of the safety light curtain.
► If the resolution is reduced, use the test rod that ensures effective resolution of the safety light curtain.
► With a reduced resolution and configured Smart Box Detection, use the test rod that matches the effective resolution of the safety light curtain with a free protective field.

**DANGER**
Hazard due to unexpected starting of the machine

► Make sure that the dangerous state of the machine is and remains switched off during the check.
► Make sure that the outputs of the safety light curtain have no effect on the machine during the check of the components.

**DANGER**
Hazard due to lack of effectiveness of the protective device

Persons and parts of the body to be protected may not be recognized in case of non-observance.

Do not operate the machine if the field indicator lights up green or yellow during the check!

- ► If the field indicator lights up green or yellow during the check (even if only briefly) work must stop at the machine.
- ► In this case, the mounting and electrical installation of the safety light curtain must be checked by qualified safety personnel.

**NOTE**
The integrated laser alignment aid switches the OSSDs to the OFF status.

- ► Ensure that the integrated laser alignment aid is switched off during the check.

**NOTE**
To test the smart presence detection, interrupt the protective field on the host device so that the OSSDs change to the OFF status. Otherwise, the guest device remains in sleep mode and the test rod check will not be very meaningful.

**Prerequisites**

- The field indicator lights up green or flashes yellow.
  The field indicator only flashes yellow if the internal restart interlock is configured and a reset is required.
- The protective field is free of objects in applications with configured Smart Box Detection.

**Approach**

1. Move the test rod slowly through the area to be protected (e.g., machine opening), as indicated by the arrow, see figure 41.
2. Watch the field indicator on the receiver during the check. The field indicator on the receiver must continuously light up red. The field indicator must not light up green or flash yellow.

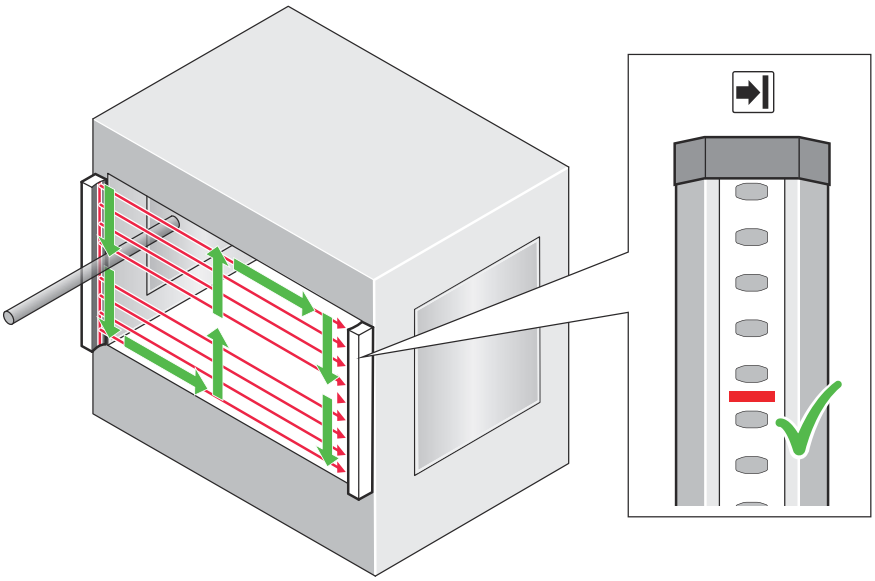


*Figure 41: Test rod check: Step 1*

3. Then, guide the test rod along the edges of the area to be protected, as indicated by the arrow, see figure 42.
4. Watch the field indicator on the receiver during the check. The field indicator on the receiver must continuously light up red. The field indicator must not light up green or flash yellow.

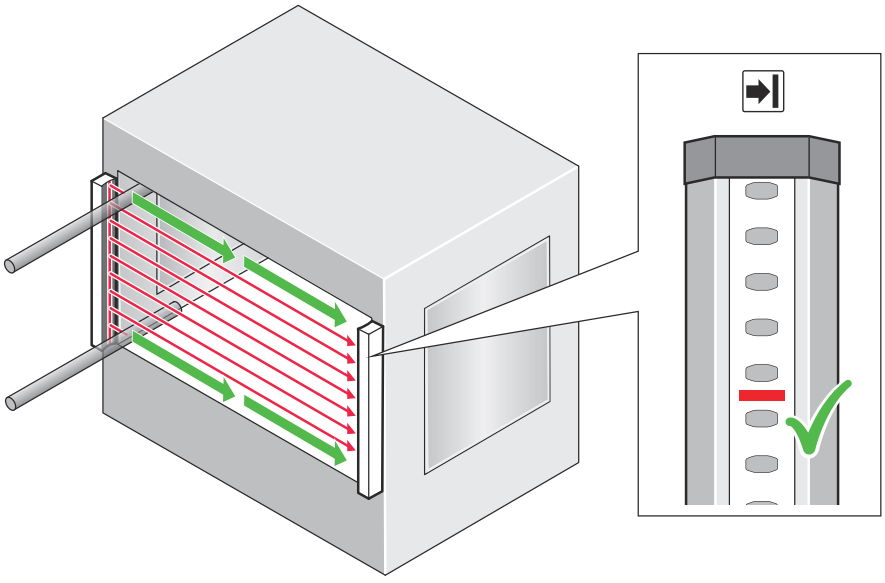


*Figure 42: Test rod check: Step 3*

5. If one or more deflector mirrors are used, then the test rod should also be guided slowly through the area to be protected directly in front of the deflector mirrors.
6. Watch the field indicator on the receiver during the check. The field indicator on the receiver must continuously light up red. The field indicator must not light up green or flash yellow.
7. After the test rod has been removed from the protective field, make sure that the protective field is clear and the field indicator is green or yellow.

8. If a dynamic protective field width is used, carry out the test rod check with minimum and maximum protective field width.
9. If multiple devices are connected with each other in a cascade, carry out the entire test for each device of the cascade. During the field indicator test, watch the device that is currently being checked.

### 4.5.2 Visual check of the machine and the protective device

The following points are often helpful for the definition of the check:

- Has the machine been retrofitted?
- Have machine parts been removed?
- Have modifications been made to the surroundings of the machine?
- Have the protective device or its parts been dismantled?
- Is it possible to enter the hazardous area without being detected?
- Is the protective device damaged?
- Is the protective device severely contaminated?
- Is the front screen contaminated, scratched or destroyed?
- Are there any damaged cables or open cable ends?
- Is the configuration of the protective device still the same?

If one of the points applies, the machine should be shut down immediately. In this case, the machine and the protective device must be checked by appropriately qualified safety personnel.

# 5 Mounting

## 5.1 Safety

### Important information

**DANGER**
Hazard due to lack of effectiveness of the protective device

If unsuitable brackets are used or if subjected to excessive vibrations, the device may become detached or damaged.

Persons and parts of the body to be protected may not be recognized in case of non-observance.

- ► Only use SICK-approved brackets for mounting.
- ► Take appropriate measures for vibration damping if vibration and shock specifications exceed the values and test conditions specified in the data sheet.

**NOTE**
Mount the device in the following order.

### Prerequisites

The safety light curtain has been designed correctly.

### Further topics

- "Design", page 26
- "Technical data", page 140

## 5.2 Unpacking

### Approach

1. Check the components for completeness and the integrity of all parts.
2. In the event of complaints, contact the responsible SICK subsidiary.

### Further topics

- "Ordering information", page 150

## 5.3 Mounting the system plug

### Overview

You must mount the system plug on the safety light curtain prior to starting mounting and electrical installation work. Please note that depending on the application, the system plug used at the sender may be different to that at the receiver.

### Important information

**DANGER**
Hazard due to lack of effectiveness of the protective device

Malfunctions can occur if the safety light curtain is connected other than with one of the system plugs provided.

- ► Use the system plugs provided.

**NOTICE**

Fitting the system plug

If the system plug is not fitted, electrostatic discharge at the contacts may damage the device.

► Prevent electrostatic discharge at the contacts.

**NOTICE**

Enclosure ratings IP 65 and IP67 only apply if the front connector is fitted.

If the system plug is not mounted, dirt, dust, or moisture may enter the device and cause damage.

► Fitting the system plug.
► Prevent the entry of dirt, dust, and moisture.

**NOTICE**

The IP65 and IP67 enclosure ratings only apply if the protective cover for the DIP switches, which is attached to the SP2 system plug, is securely closed.

**Approach**

1. Make sure that the safety light curtain and system plug are disconnected from the voltage supply while the system plug is being mounted.
2. Unpack the system plug.
3. Adjust the DIP switches as necessary.
   When using an SP2 system plug, open the protective cover for the DIP switches, set the DIP switches, then securely close the protective cover again.
4. Remove the protective film from the terminal compartment of the safety light curtain.
5. Carefully mount the system plug on the terminal compartment of the safety light curtain.
6. Use the 2 captive screws to screw the system plug onto the safety light curtain. Torque 0.5 Nm ± 0.1 Nm.

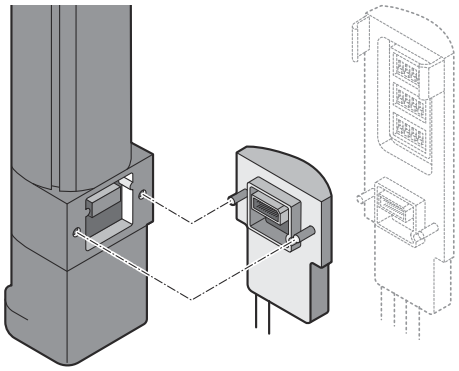


*Figure 43: Mounting the system plug*

## 5.4 Installation

### Important information

**DANGER**
Hazard due to lack of effectiveness of the protective device

Persons or parts of the body to be protected may not be recognized or not recognized in time in case of non-observance.

- ► Observe the calculated minimum distances for the machine in which the safety light curtain is integrated.
- ► Then, mount the safety light curtain such that it is not possible to reach over, under or around, or to stand behind the safety light curtain, and that the light curtain cannot be repositioned.

**DANGER**
Hazard due to lack of effectiveness of the protective device

Persons and parts of the body to be protected may not be recognized in case of non-observance.

- ► The end with the cable connection must point in the same direction for the sender and receiver.

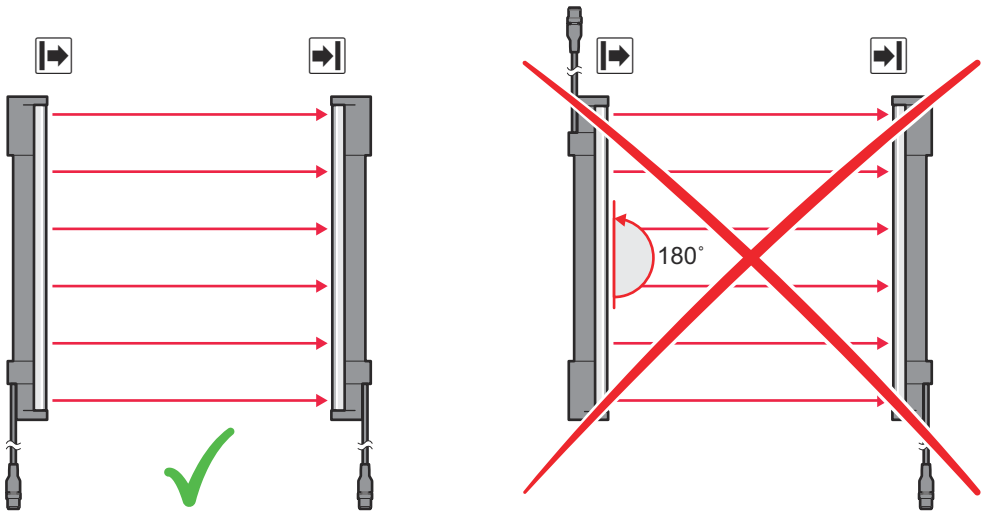
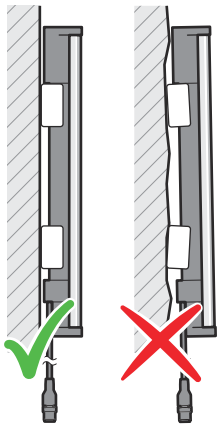



*Figure 44: Sender and receiver must not be installed such that they are rotated 180° relative to each other*

### Notes on mounting

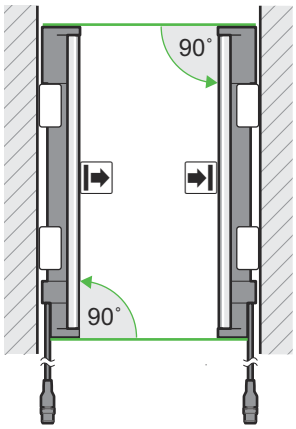
- ► Mount the sender and receiver on a level surface (❶).

❶



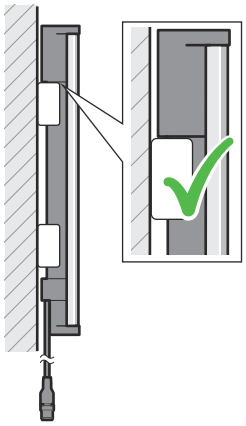
► Mount the sender and receiver such that a right-angled protective field is established, i.e., when mounted vertically at the same height. For minor adjustments during alignment, the sender and receiver can be adjusted longitudinally in the brackets (❷).

❷



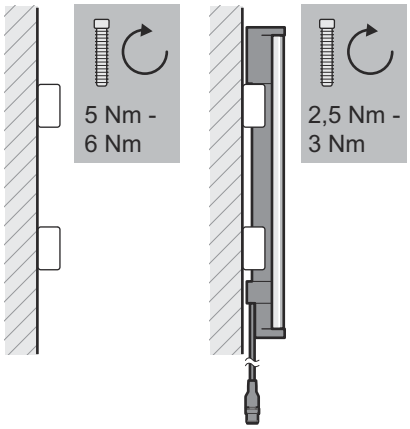

► Position the brackets near the ends of the housing. For devices with a protective field height > 300 mm, the distance between the bracket and the end of the housing must not exceed 1/4 of the length of the housing. If the device is exposed to strong vibrations during operation, mount the top bracket at a height where the offset in the safety light curtain housing rests on the bracket (❸).

❸



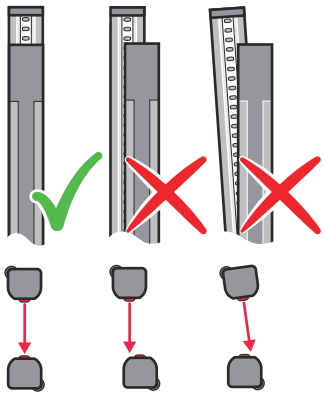
- Tightening torque for the screws used to mount the bracket: 5 Nm to 6 Nm. Tightening torque for the screws used to secure the safety light curtain in the bracket: 2.5 Nm to 3 Nm (❹). Higher torques can damage the bracket, while lower torques are not secure enough to prevent the safety light curtain from moving.

❹



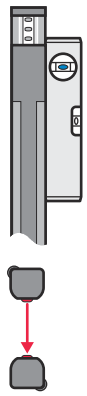

- Make sure that the sender and receiver are aligned correctly. The optical lens systems of the sender and the receiver must be located opposite one another (❺).

❺



- If necessary, use a spirit level to check that the components are parallel (❻).

❻



**NOTE**

When mounting the brackets, take into account that the brackets cannot be mounted at the same height if different system plugs are used on the sender and receiver.

### Further topics

- "Minimum distance from the hazardous point", page 28
- "Minimum distance to reflective surfaces", page 31
- "Sender and receiver alignment", page 110
- "Alignment with the QuickFix bracket", page 112
- "Alignment with the FlexFix bracket or with the upgrade bracket", page 113

## 5.4.1 Mounting the QuickFix bracket

### Overview

2 QuickFix brackets are used to mount the sender and receiver.

The QuickFix bracket consists of 2 parts, which are pushed into each other. The two individual parts are connected with an M5 screw and the housing (sender or receiver) is clamped with form-fit clamping.

The two mounting surfaces for the brackets of the sender or receiver must be parallel and lie in the same plane.

### Important information

**NOTE**

**The following should be considered when mounting the QuickFix bracket:**

- Select the appropriate length of the M5 screw to prevent any risk of injury from an overrun.
- When selecting the screw length, observe the wall thickness and the depth of the countersunk screw of the QuickFix bracket, see figure 67, page 153

**NOTE**

The QuickFix bracket has cable routing. Depending on the installation, the cable routing can make mounting easier.

### Mount QuickFix bracket on a machine or profile frame

*Table 21: Side and rear mounting with the QuickFix bracket*

| Mounting method | Description |
|---|---|
| On the side | Fasten the M5 screw to the machine or profile frame through the QuickFix bracket. A screw nut or threaded hole is required on the machine or profile frame (❶). |
| | Fasten the M5 screw to the QuickFix bracket through the machine or profile frame. A screw nut is required for each QuickFix bracket (❷). |
| | Fasten the M5 screw to the profile frame through the QuickFix bracket. A sliding nut is required on the profile frame (❸). |
| On the back | Fasten the M5 screw to the machine or profile frame through the QuickFix bracket. A screw nut or threaded hole is required on the machine or profile frame (❹). |

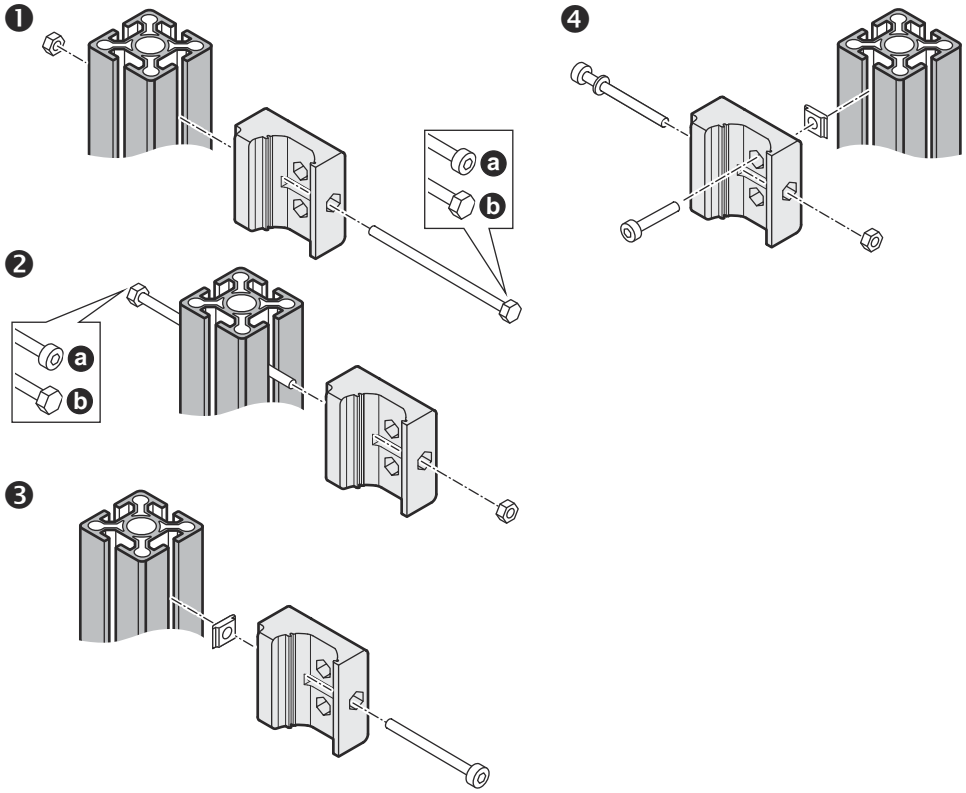



*Figure 45: Mounting the QuickFix bracket to a profile*

### 5.4.2 Mounting the FlexFix bracket

#### Overview

In the FlexFix bracket, the sender and receiver can be rotated ± 15° around their longitudinal axis.

2 FlexFix brackets are used to mount the sender and receiver.

As a rule, each FlexFix bracket is mounted to the mounting surface with 2 screws. In exceptional cases (e.g. reduced vibration and shock requirements), a FlexFix bracket can be mounted with only one screw if this does not impair the function.

#### Important information

**NOTICE**

The housing of the safety light curtain can become scratched if the screw heads protrude when the FlexFix brackets are mounted on the back.

This can be avoided by taking one of the following measures:

- ► Use flat-head screws with washers.
- ► If using cylinder head screws, use 2 screws per bracket and no washers.

**NOTE**

The FlexFix mounting kit (part number 2073543) contains 2 FlexFix brackets, one alignment tool, and the required screws, sliding nuts, and washers.

#### Further topics

- "Brackets", page 153

### 5.4.2.1 Mounting the FlexFix bracket on a machine or profile frame

#### Important information

**NOTE**
When selecting the screw length, the wall thickness of the FlexFix bracket must be taken into account.

#### Mounting type

*Table 22: Lateral and rear mounting with the FlexFix bracket*

| Mounting method | Description |
|---|---|
| On the side | With the M5 screw through the FlexFix bracket on the machine or profile frame. A screw nut or threaded hole is required on the machine or profile frame (❶). |
| | With the M5 screw through the FlexFix bracket on the profile frame. 2 sliding nuts are required on the profile frame (❷). |
| On the back | With the M5 screw through the FlexFix bracket on the machine or profile frame. A screw nut or threaded hole is required on the machine or profile frame (❸). |

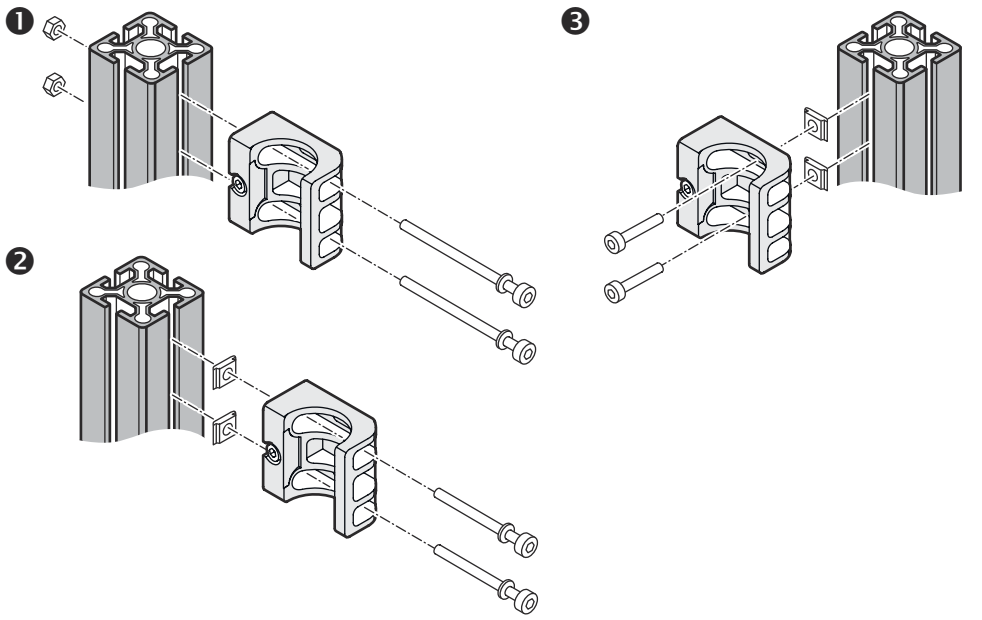



*Figure 46: Mounting the FlexFix bracket to a profile frame*

#### Approach

1. After assembling the FlexFix brackets, screw the sender or receiver into the FlexFix brackets from the front. (❶)
2. Align the sender and receiver. (❷)
3. Use an M5 screw to secure the position of the sender and receiver in the FlexFix bracket. (❸)

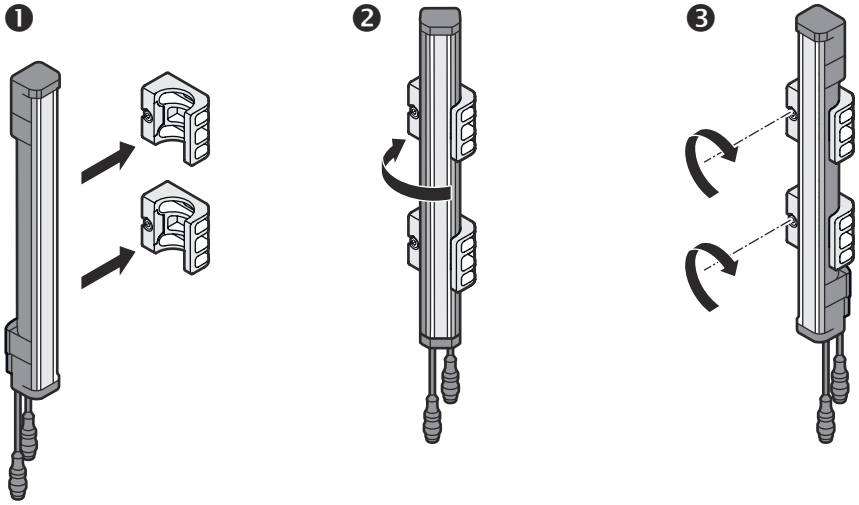



*Figure 47: Inserting the safety light curtain in the FlexFix brackets*

**NOTE**

The protective device can only be screwed in when both FlexFix brackets are in alignment.

Recommendation:

1. Only hand-tighten the screws on the FlexFix brackets at first.
2. Align the two FlexFix brackets. To do this, place a straightedge or spirit level, for example, on the screw mounting surfaces of the FlexFix brackets that are not being used.
3. Tighten the screws.

**Further topics**

- "Sender and receiver alignment", page 110
- "Brackets", page 153

### 5.4.2.2 Mount FlexFix bracket to the back of a device column

**Overview**

The FlexFix bracket can be mounted in the device column using sliding nuts.

Use washers between the FlexFix brackets and the device column if you want to mount the sender and receiver in the center of the device column.

**Approach**

1. After assembling the FlexFix brackets, screw the sender or receiver into the FlexFix brackets from the front.
2. Align the sender and receiver.
3. Use an M5 screw to secure the position of the sender and receiver in the FlexFix bracket.

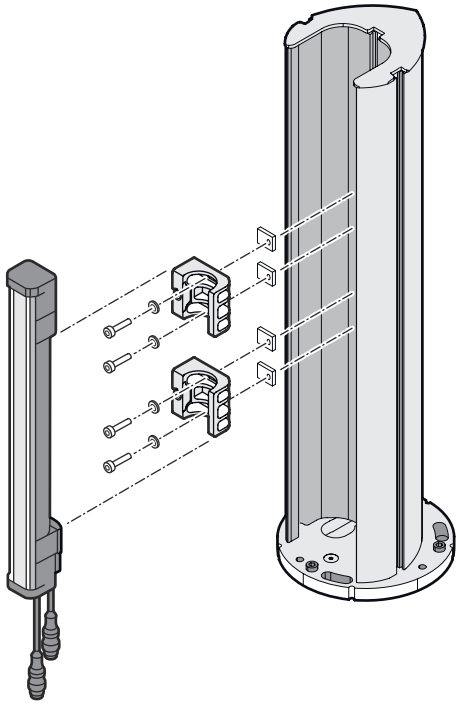


*Figure 48: Mounting the FlexFix bracket to a device column (accessory)*

**Further topics**

- "Sender and receiver alignment", page 110

### 5.4.3 Mounting the upgrade bracket

**Overview**

If an existing C4000 safety light curtain is mounted with a swivel-mount bracket or with a side bracket, it can be replaced with a deTec4 safety light curtain using a replacement bracket. There is no need to drill new holes, since the existing ones can be used for the replacement bracket.

**Complementary information**

Additional information for mounting a safety light curtain with a replacement bracket can be found in the mounting instructions for the replacement bracket.

# 6 Electrical installation

## 6.1 Safety

### Important information

**DANGER**
Hazard due to electrical voltage
Hazard due to unexpected starting of the machine

- ► Make sure that the machine is (and remains) disconnected from the voltage supply during the electrical installation.
- ► Make sure that the dangerous state of the machine is (and remains) switched off during electrical installation.
- ► Make sure that the outputs of the safety light curtain have no effect on the machine during the electrical installation work.
- ► Use a suitable voltage supply.

**DANGER**
Hazard due to lack of effectiveness of the protective device
The dangerous state may not be stopped in the event of non-compliance.

- ► Always connect the two OSSDs separately. The two OSSDs must not be connected to each other.
- ► Connect the OSSDs such that the machine controller processes both signals separately.

**DANGER**
Hazard due to lack of effectiveness of the protective device
The dangerous state may not be stopped in the event of non-compliance.

- ► Prevent the formation of a potential difference between the load and the protective device.

**DANGER**
Hazard due to lack of effectiveness of the protective device
Malfunctions can occur if unused inputs are wired incorrectly.

- ► Unused inputs must either not be connected or be permanently switched to LOW.

**DANGER**
Hazard due to lack of effectiveness of the protective device
The protective device can become disabled if the system connection cable is connected incorrectly.

- ► Make sure (e.g. by routing the cables appropriately) that the system connection cable can only be connected to the system connection of the protective device.

### Prerequisites

- The safety light curtain has been safely integrated into the control system and the electrical system of the machine.
- Mounting has been correctly executed.

**Example: Isolated connection of OSSD1 and OSSD2**

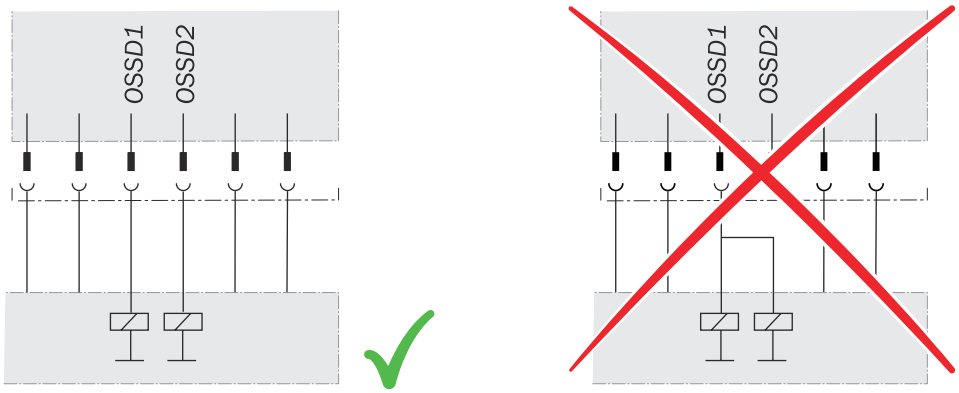



*Figure 49: Dual-channel and isolated connection of OSSD1 and OSSD2*

**Avoiding any potential difference between load and protective device**

If you connect loads to the output signal switching devices (switching outputs) that then also switch if controlled with negative voltage (e.g., electro-mechanical contactor without reverse polarity protection diode), you must connect the 0 V connections of these loads and those of the corresponding protective device separately and also directly to the same 0 V terminal strip. In the event of a fault, this is the only way to ensure that there can be no potential difference between the 0 V connections of the loads and those of the corresponding protective device.

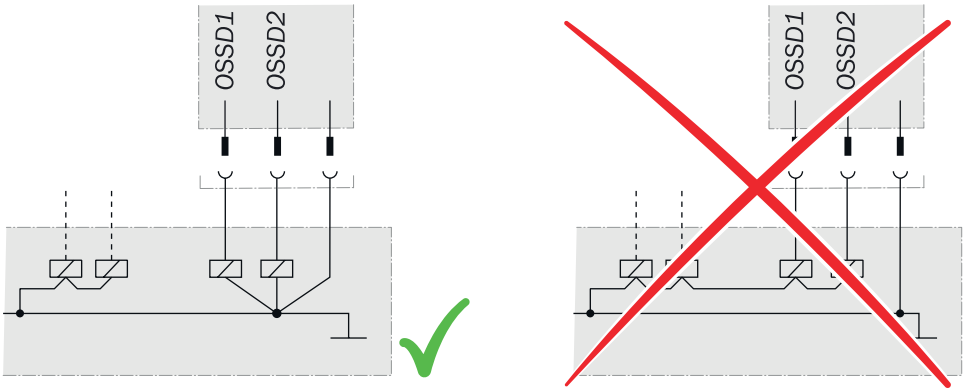



*Figure 50: No potential difference between load and protective device*

**Further topics**

- "Integration in electrical control", page 54
- "Technical data", page 140

## 6.2 System connection (M12, 5-pin)

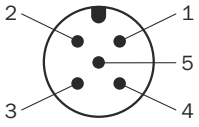



*Figure 51: System connection (male connector, M12, 5-pin)*

*Table 23: System connection pin assignment (male connector, M12, 5-pin)*

| Pin | Wire color [1] | Sender | Receiver |
|---|---|---|---|
| 1 | Brown | +24 V DC (voltage supply input) | +24 V DC (voltage supply input) |
| 2 | White | In2<br>(laser alignment aid push-button) | OSSD1 (switching output 1) |
| 3 | Blue | 0 V DC (voltage supply input) | 0 V DC (voltage supply input) |
| 4 | Black | In1<br>(laser alignment aid switch/cascade synchronization input) | OSSD2 (output signal switching device 2) |
| 5 [2] | Gray | MFP1<br>(Single system or host: sender/receiver communication<br>Guest: cascade communication) | MFP1<br>(Single system or host: sender/receiver communication<br>Guest: cascade communication) |

1) Applies to the extension cables recommended as accessories.
2) If the sender and the receiver are not connected, pin 5 can remain unassigned for a single system or host and, for example, a 4-pin cable with a 4-pin female connector can be used.

If the SP2 system plug is used at the receiver, the pin assignment at the system connection may differ depending on the configuration.

**Further topics**

- "Integration in electrical control", page 54

## 6.3 System connection (M12, 8-pin)

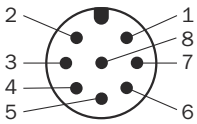



*Figure 52: System connection (male connector M12, 8-pin)*

*Table 24: System connection pin assignment for SP1 system plug (M12 male connector, 8-pin)*

| Pin | Wire color [1] | Sender | Receiver |
|---|---|---|---|
| 1 | White | Not assigned | In3<br>RES (reset pushbutton input) |
| 2 | Brown | +24 V DC (voltage supply input) | +24 V DC (voltage supply input) |
| 3 | Green | Not assigned | MFP3<br>ADO (application diagnostic output) |
| 4 | Yellow | Not assigned | In4<br>EDM (external device monitoring input) |
| 5 | Gray | In2<br>(laser alignment aid push-button) | OSSD1 (switching output 1) |

| Pin | Wire color [1] | Sender | Receiver |
|---|---|---|---|
| 6 | Pink | In1<br>(laser alignment aid switch/cascade synchronization input) | OSSD2 (output signal switching device 2) |
| 7 | Blue | 0 V DC (voltage supply input) | 0 V DC (voltage supply input) |
| 8 | Red | MFP1<br>(Single system or host: sender/receiver communication) | MFP1<br>(Single system or host: sender/receiver communication) |

1) Applies to the extension cables recommended as accessories.

*Table 25: System connection pin assignment for SP2 system plug (M12 male connector, 8-pin)*

| PIN | Wire color [1] | Receiver |
|---|---|---|
| 1 | White | In3<br>RES (reset pushbutton input) or override (override input) |
| 2 | Brown | +24 V DC (voltage supply input) |
| 3 | Green | MFP3<br>ADO (application diagnostic output) |
| 4 | Yellow | In4<br>EDM (EDM input) or muting signal 1 |
| 5 | Gray | OSSD1 (switching output 1) |
| 6 | Pink | OSSD2 (output signal switching device 2) |
| 7 | Blue | 0 V DC (voltage supply input) |
| 8 | Red | MFP1<br>(Single system or host: sender/receiver communication) |

1) Applies to the connecting cables recommended as accessories.

### Further topics

- "Integration in electrical control", page 54

## 6.4 Extension connection (M12, 5-pin)

### Pin assignment at the extension connection

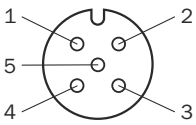



*Figure 53: Extension connection (female connector M12, 5-pin)*

*Table 26: SP1 system plug extension connection pin assignment (M12 female connector, 5-pin)*

| PIN | Wire color [1] | Sender | Receiver |
|---|---|---|---|
| 1 | Brown | 24 V Out (voltage supply output) [2] | 24 V Out (voltage supply output) [2] |
| 2 | White | Not assigned | In1<br>(Single system or last guest: EDM [EDM input]<br>Host or first of 2 guests: OSSD input) |
| 3 | Blue | 0 V Out (voltage supply output) | 0 V Out (voltage supply output) |
| 4 | Black | Sync-Out (cascade synchronization output) | In2<br>(Single system or last guest: RES [reset pushbutton input]<br>Host or first of 2 guests: OSSD input) |
| 5 | Gray | MFP2 (cascade communication) | MFP2<br>(Single system or last guest: ADO [application diagnostic output] / IO-Link<br>Host or first of 2 guests: cascade communication) |

1) Applies to the connecting cables recommended as accessories.
2) Only for cascading deTec devices, not suitable for connecting other devices.

*Table 27: SP2 system plug extension connection pin assignment (M12 female connector, 5-pin)*

| PIN | Wire color [1] | Receiver |
|---|---|---|
| 1 | Brown | 24 V Out (voltage supply output) [2] |
| 2 | White | In1<br>(Single system: EDM [EDM input] [3] / muting signal 1<br>Host: OSSD input) |
| 3 | Blue | 0 V Out (voltage supply output) |
| 4 | Black | In2<br>(Single system: RES [reset pushbutton input] / muting signal 2<br>Host: OSSD input) |
| 5 | Gray | MFP2<br>(Single system: ADO [application diagnostic output] / IO-Link<br>Host: cascade communication) |

1) Applies to the connecting cables recommended as accessories.
2) Only for cascading deTec devices, not suitable for connecting other devices.
3) When muting is configured, EDM is not possible at the extension connection.

### Further topics

- "Integration in electrical control", page 54

# 7 Configuration

## 7.1 Overview

### Important information

*Table 28: Functions and their configuration type*

| Function | Configuration type |
|---|---|
| Muting | DIP switch |
| Partial blanking | |
| Scanning range adjustment | |
| Reduced resolution | |
| Smart presence detection | |
| Beam coding | |
| Smart Box Detection | |
| Set to factory settings | |
| Restart interlock | Automatic configuration |
| External device monitoring (EDM) | |
| Cascading | |
| Application diagnostic output | |
| Status indication on both sides | |

**The following system plugs are available for configuring via a DIP switch:**

- SP1 system plug
- SP2 system plug

The SP1 system plug can be used on all of the senders and receivers of a single system or on a host–guest system.

The SP2 system plug is only used on the receiver of a host system or single system. The SP1 system plug is used on all other receivers of the guest systems and on all senders.

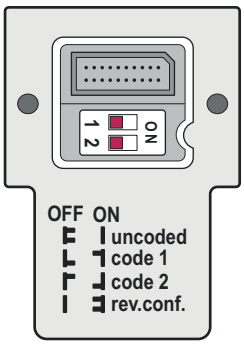



*Figure 54: SP1 system plug with 2 DIP switches*

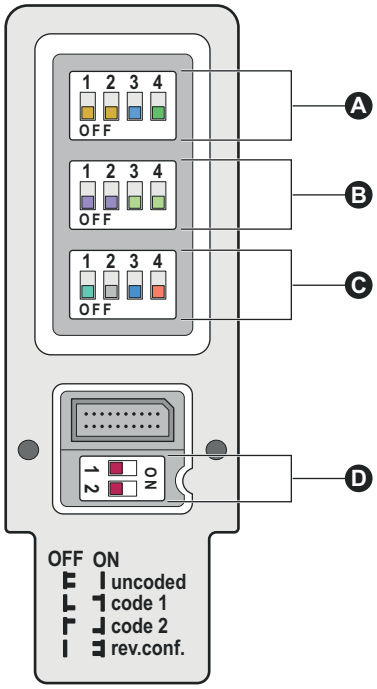



*Figure 55: SP2 system plug with 14 DIP switches*

*Table 29: Overview of DIP switches*

| Row | DIP switch | Function |
|---|---|---|
| A [1] | 1, 2, 3, 4 | Muting, see "Configuring muting", page 97 |
| B [1] | 1, 2 | Scanning range adjustment, see "Configuring the scanning range", page 98 |
| | 3, 4 | Reduced resolution, see "Configuring reduced resolution", page 99 |
| C [1] | 1 | Smart presence detection, see "Configuring smart presence detection", page 100 |
| | 2 | Not assigned |
| | 3 | Smart Box Detection [2], see "Configuring Smart Box Detection", page 101 |
| | 4 | Parity, see "Checking the parity", page 102 |
| D | 1, 2 | • Beam coding, see "Configuring beam coding", page 96<br>• Reset to factory settings, see "Reset to factory settings", page 94 |

1) Only applies to SP2 system plug.
2) On devices with range of functions 1.0.0, DIP switch 3 is not assigned.

### Configuration information

- ► Check the parity using the SP2 system plug after setting the DIP switches. The sum of the DIP switches of rows A, B and C set to On must be even. In case of an uneven sum, change the setting of DIP switch 4 (row C).
- ► Securely close the protective cover for the DIP switches, which is attached to the SP2 system plug.
- ► Then ensure the correct functioning of the device.

**Further topics**

- "System plug", page 17
- "Configuring the restart interlock", page 103
- "Configuring external device monitoring (EDM)", page 104
- "Configuring cascading", page 106
- "Status indication on both sides", page 108

## 7.2 Possible combinations of functions on SP2 system plug

*Table 30: Possible combinations of functions on SP2 system plug*

| Function | Beam coding | Restart interlock (In2) | Restart interlock (In3) | EDM (In1) | EDM (In4) | Cascading | Smart presence detection | Muting (In1, In2) | Muting (In2, In4) | Partial blanking | Smart Box Detection | Reduced resolution | Dynamic protective field width |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Beam coding** | – | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **Restart interlock at extension connection (In2)** | ✓ | – | – | ✓ | ✓ | ✓ | ✓ | – | – | ✓ | ✓ | ✓ | ✓ |
| **Restart interlock at system connection (In3)** | ✓ | – | – | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **External device monitoring (EDM) at extension connection (In1)** | ✓ | ✓ | ✓ | – | – | ✓ | ✓ | – | – | ✓ | ✓ | ✓ | ✓ |
| **External device monitoring (EDM) at the system connection (In4)** | ✓ | ✓ | ✓ | – | – | ✓ | ✓ | ✓ | – | ✓ | ✓ | ✓ | ✓ |
| **Cascading** | ✓ | ✓ | ✓ | ✓ | ✓ | – | ✓ | – | – | – | – | ✓ | ✓ |
| **Smart presence detection** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | – | – | – | – | – | ✓ | ✓ |
| **Muting at the extension connection (In1, In2)** | ✓ | – | ✓ | – | ✓ | – | – | – | – | ✓ | – | ✓ | ✓ |
| **Muting at extension connection In2 and at system connection In4** | ✓ | – | ✓ | – | – | – | – | – | – | ✓ | – | ✓ | ✓ |
| **Partial blanking** | ✓ | ✓ | ✓ | ✓ | ✓ | – | – | ✓ | ✓ | – | – | – | ✓ |
| **Smart Box Detection** | ✓ [1] | ✓ | ✓ | ✓ | ✓ | – | – | – | – | – | – | ✓ | ✓ |
| **Reduced resolution** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | – | ✓ | – | ✓ |
| **Dynamic protective field width** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | – |

✓ Functions can be combined with each other.
– Functions cannot be combined with each other.
1) Smart Box Detection and beam coding (code 1 and code 2) can be combined up to a maximum protective field height of 1,650 mm.

## 7.3 Factory settings

*Table 31: Configurable functions when delivered*

| Function | Configuration when delivered |
|---|---|
| Beam coding. | Uncoded |

| Function | Configuration when delivered |
|---|---|
| Restart interlock | Not configured |
| External device monitoring (EDM) | Not configured |
| Cascading | Single system |
| Smart presence detection | Not configured |
| Reduced resolution | Not configured |
| Muting | Not configured |
| Partial blanking | Not configured |
| Smart Box Detection | Not configured |
| Scanning range adjustment | Automatic calibration of the protective field width |

### Complementary information

**The device must be reset to the factory settings to change the configuration to the following functions:**

- External device monitoring (EDM)
- Restart interlock
- Cascading

All other functions can be changed subsequently without resetting the safety light curtain to factory settings.

### Further topics

- "Reset to factory settings", page 94

## 7.3.1 Reset to factory settings

### Overview

The sender and receiver are reset to factory settings independently of each other. The procedure is the same for the sender and receiver.

**The following functions must be reset to factory settings following a certain procedure:**

- External device monitoring (EDM)
- Restart interlock
- Cascading

The device must also be reset to the factory settings if the device has previously used the functions of the SP2 system plug and is now to be operated with an SP1 system plug.

All other functions will be reset to the factory settings by setting the DIP switches to Off.

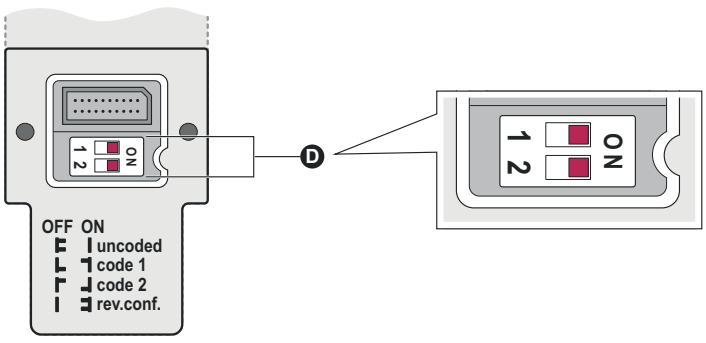



*Figure 56: Reset to factory settings*

### Approach

1. Disconnect the device from the voltage supply.
2. Disconnect the device from all connected devices.
3. In order to reset the restart interlock, external device monitoring (EDM) and cascading, set DIP switches 1 and 2 (row D) to On, see figure 56.
4. Switch on the voltage supply and disconnect it again within 10 s. [5] During this time, the field indicator flashes alternately yellow and green.
5. Set DIP switches 1 and 2 (row D) to Off.
6. Switch on the voltage supply.

✓ The field indicator flashes green.
✓ Sender: the STATE LED lights up red.
✓ Receiver: the OSSD light emitting diode lights up red.
✓ The external device monitoring (EDM), restart interlock and cascading functions are reset to the factory settings.
✓ If the devices are connected in a cascade, the cascading is reconfigured.
✓ If there is a 24 V voltage present at the EDM input, the EDM is reactivated.

7. Disconnect the device from the voltage supply.

In order to reset the remaining functions to factory settings, set the DIP switches to Off.

### Complementary information

In a cascade, only the host device needs to be reset. The guest devices take on those settings.

If the sender and receiver are connected with each other in a cascade using a cable, only the receiver of the host device must be reset. The sender of the host device and all other guest devices take on those settings.

## 7.4 Configuration mode

*Table 32: Configuration mode*

| | Sender | Receiver |
|---|---|---|
| Configuration mode is active | • When resetting the sender to the factory settings<br>• A permissible change of cascading was discovered during switch-on | • When resetting the receiver to the factory settings<br>• A permissible change of cascading was discovered during switch-on<br>• A permissible change to the external device monitoring configuration has been discovered during switch-on<br>• The reset pushbutton was pressed in order to configure the restart interlock following switch-on |
| Display of the configuration mode | • Field indicator: Green<br>• STATE LED: Red | • Field indicator: Green<br>• OSSD LED: Red |

○ LED off. LED flashes. ● LED illuminates.

**Provided that the device is in configuration mode, you can make further changes to the configuration:**

- Configuring the restart interlock

### Stopping configuration mode

► Briefly interrupt the voltage supply, then switch it back on.

5) If the supply voltage is present for longer than 10 s, the safety light curtain changes to the locking state. Start again from step 1.

## 7.5 Configuring beam coding

### Overview

The beam coding “uncoded” allows for particularly short response times.

To protect against interference from systems in close proximity to each other, code 1 and code 2 must be used

The beam coding must be the same for the sender and receiver.

In a cascade, the beam coding is set on the sender and receiver of the host device and taken on by all guest devices. Deviating settings for the guest devices are ignored.

### Configuring beam coding

The beam coding is configured using 2 DIP switches. The DIP switches are located on the inside of the system plug.

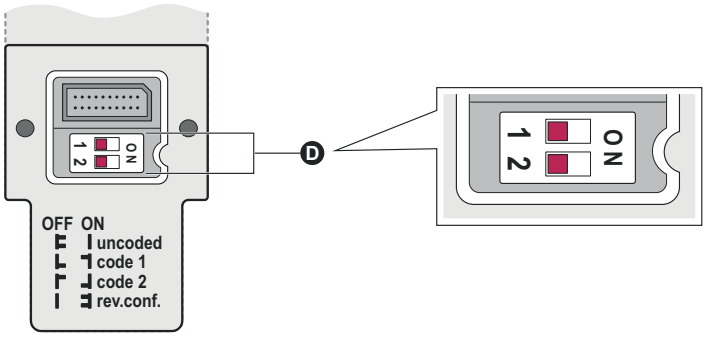



*Figure 57: Configuring beam coding*

*Table 33: DIP switches and beam coding*

| DIP switch 1 (row D) | DIP switch 2 (row D) | Function |
|---|---|---|
| Off | Off | Uncoded (fast response time, delivery status) |
| On | Off | Code 1 (protection against interference from systems in close proximity to each other) |
| Off | On | Code 2 (protection against interference from systems in close proximity to each other) |
| On | On | Reset to factory settings |

**The beam coding is indicated when the safety light curtain is switched on:**

- Uncoded: the field indicator does not flash yellow
- Code 1: the field indicator flashes yellow once
- Code 2: the field indicator flashes yellow twice

### Complementary information

You can also change the beam coding later. You do not need to reset the safety light curtain to the factory settings to do this.

During the first change to the beam coding, diagnostic LED 3 flashes white for 3 s. Afterwards, the diagnostic LED lights up white steadily.

Beam coding does not have to be taken into account for the parity test.

### Further topics

- "Protection against interference from systems in close proximity to each other", page 33
- "Factory settings", page 93

## 7.6 Configuring muting

### Overview

Muting is configured using the DIP switches 1 to 4 (row A) on the receiver of a single system.

Depending on arrangement of the muting sensors, cross-muting or exit monitoring can be configured and the safety light curtain protection can be temporarily bypassed. In combination with partial blanking, the safety can be increased by having the topmost beam (far from system plug) remain active during a valid muting condition. A muting signal can be moved from the extension connection to the system connection.

### Important information

**NOTE**
Muting is only configured on the receiver of a single system.

### Prerequisites

- SP2 system plug

### Configuring muting

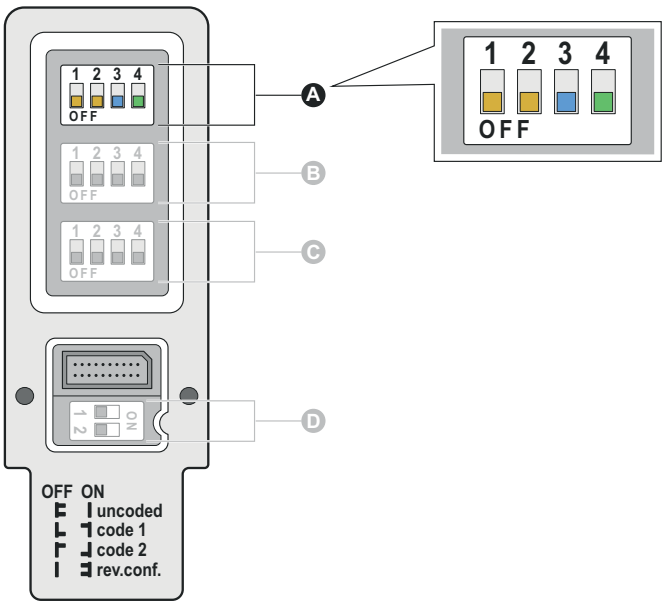



*Figure 58: DIP switch for muting on the SP2 system plug*

*Table 34: DIP switch and muting*

| DIP switch 1 (row A) | DIP switch 2 (row A) | DIP switch 3 (row A) | DIP switch 4 (row A) | Function |
|---|---|---|---|---|
| Off | Off | Off | Off | Muting deactivated (delivery condition) |
| Off | On | Off | Off | Cross muting |

| DIP switch 1 (row A) | DIP switch 2 (row A) | DIP switch 3 (row A) | DIP switch 4 (row A) | Function |
|---|---|---|---|---|
| Off | On | Off | On | Cross-muting with muting signal 1 on system connection In4 and muting signal 2 on extension connection In2 |
| Off | On | On | Off | Partial blanking based on cross-muting |
| Off | On | On | On | Partial blanking based on cross-muting with muting signal 1 on system connection In4 and muting signal 2 on extension connection In2 |
| On | Off | Off | Off | Exit monitoring [1) 2) 3)] |
| On | Off | Off | On | Exit monitoring with muting signal 1 on system connection In4 and muting signal 2 on extension connection In2[1) 2) 3)] |
| On | Off | On | Off | Partial blanking based on exit monitoring [1) 2) 3)] |
| On | Off | On | On | Partial blanking based on exit monitoring with muting signal 1 on system connection In4 and muting signal 2 on extension connection In2[1) 2) 3)] |

1) Muting hold time of 4 s.
2) Muting end by ESPE active.
3) Muting end delay of 200 ms.

### Note on configuration

► Check the parity after setting the DIP switch, see "Checking the parity", page 102.

## 7.7 Configuring the scanning range

### Important information

**NOTE**
The scanning range is only configured on the receiver of a single or host system.

**DANGER**
Incorrect scanning width setting for dynamic protective field widths in the case of devices with a resolution of 14 mm

Detection capability is no longer guaranteed. Persons and parts of the body to be protected may not be detected.

► In cases where the actual protective field width may be less than 1 m, configure the dynamic protective field width (small range).
► In cases where the actual protective field width is always at least 1 m, but may be less than 2 m, configure the dynamic protective field width (medium range).

### Prerequisites

- SP2 system plug

### Configuring the scanning range

The scanning range of the safety light curtain is configured using DIP switches 1 and 2 (row B) on the system plug of the receiver.

The scanning range configuration is taken on by all guest devices in a cascade.

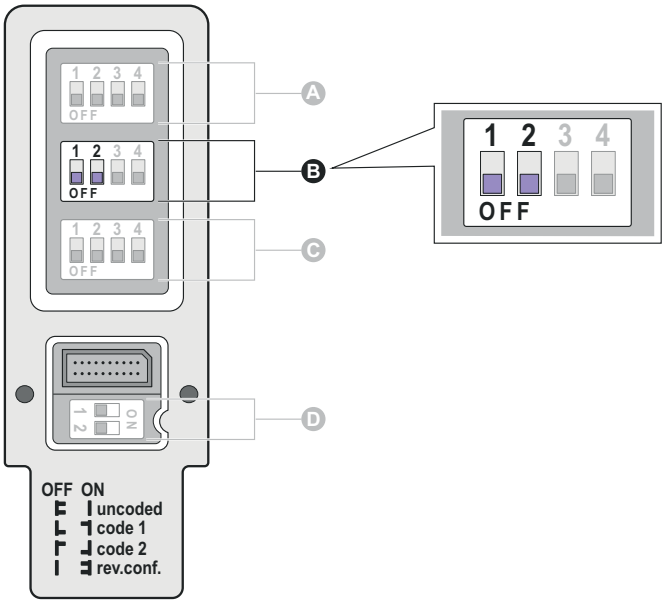



*Figure 59: DIP switches for scanning ranges on SP2 system plug*

*Table 35: DIP switches and scanning range*

| DIP switch 1 (row B) | DIP switch 2 (row B) | Function |
|---|---|---|
| Off | Off | Automatic calibration of the protective field width (delivery condition) |
| Off | On | Dynamic protective field width (small range) |
| On | Off | Dynamic protective field width (medium range) |
| On | On | Dynamic protective field width (large range) |

### Note on configuration

► Check the parity after setting the DIP switch, see "Checking the parity", page 102.

## 7.8 Configuring reduced resolution

### Important information

**NOTE**
Reduced resolution is only configured on the receiver of a single or host system.

### Prerequisites

- SP2 system plug

### Configuring reduced resolution

Reduced resolution is configured using DIP switches 3 and 4 (row B) on the system plug of the receiver.

The reduced resolution configuration is taken on by all guest devices in a cascade.

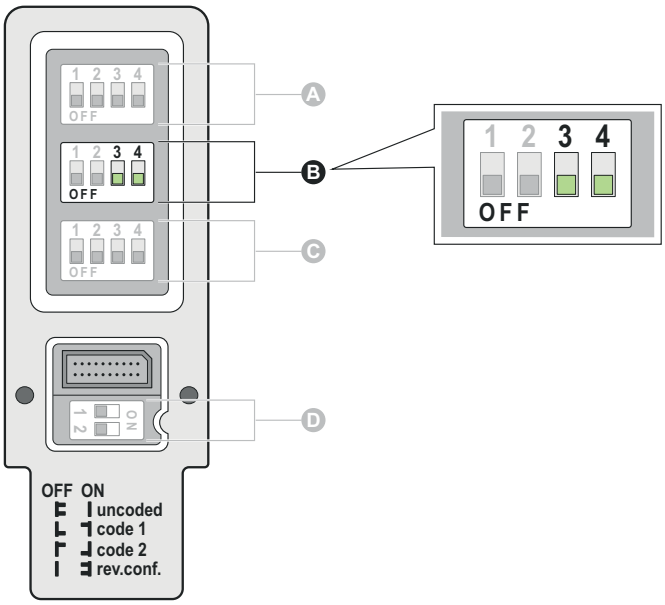



*Figure 60: DIP switch for reduced resolution on SP2 system plug*

*Table 36: DIP switches and reduced resolution*

| DIP switch 3 (row B) | DIP switch 4 (row B) | Function |
|---|---|---|
| Off | Off | Reduced resolution inactive (delivery condition) |
| Off | On | 1 beam |
| On | Off | 2 beams |
| On | On | Not allowed |

### Note on configuration

► Check the parity after setting the DIP switch, see "Checking the parity", page 102.

## 7.9 Configuring smart presence detection

### Important information

**NOTE**
Smart presence detection is only configured on the receiver of a host system.

### Prerequisites

- SP2 system plug
- Cascade

### Configuring smart presence detection

Smart presence detection is configured using DIP switch 1 (row C) on the system plug of the receiver.

The smart presence detection configuration is taken on by all guest devices in a cascade.

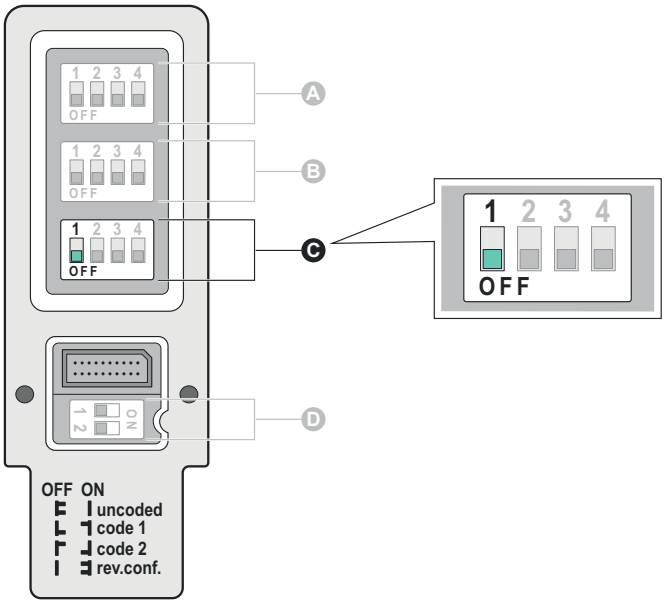



*Figure 61: DIP switch for smart presence detection on SP2 system plug*

*Table 37: DIP switch and smart presence detection*

| DIP switch 1 (row C) | Function |
|---|---|
| Off | Smart presence detection inactive (delivery condition) |
| On | Smart presence detection active |

**Note on configuration**

► Check the parity after setting the DIP switch, see "Checking the parity", page 102.

## 7.10 Configuring Smart Box Detection

**Overview**

Smart Box Detection is configured via DIP switch 3 (row C) on the receiver of a single system.

**Important information**

**NOTE**
Smart Box Detection can only be configured on the receiver of a single system.

**Prerequisites**

- SP2 system plug
- Single device with a resolution of 14 mm

### Configuring Smart Box Detection

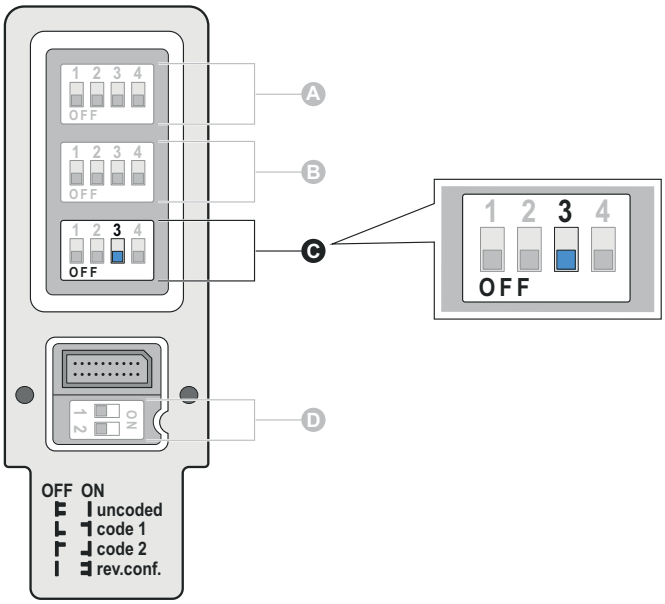



*Figure 62: DIP switch for Smart Box Detection on SP2 system plug*

*Table 38: DIP switch and Smart Box Detection*

| DIP switch 3 (row C) | Function |
|---|---|
| Off | Smart Box Detection deactivated (delivery state) |
| On | Smart Box Detection active |

### Note on configuration

► Check the parity after setting the DIP switch, see "Checking the parity", page 102.

## 7.11 Checking the parity

The parity must be checked after setting the DIP switches. The parity specifies whether the sum of the DIP switches set to On is even or uneven.

Parity is only calculated for the DIP switches of rows A, B and C. DIP switches 1 and 2 of row D are not included.

The parity is set using DIP switch 4 (row C).

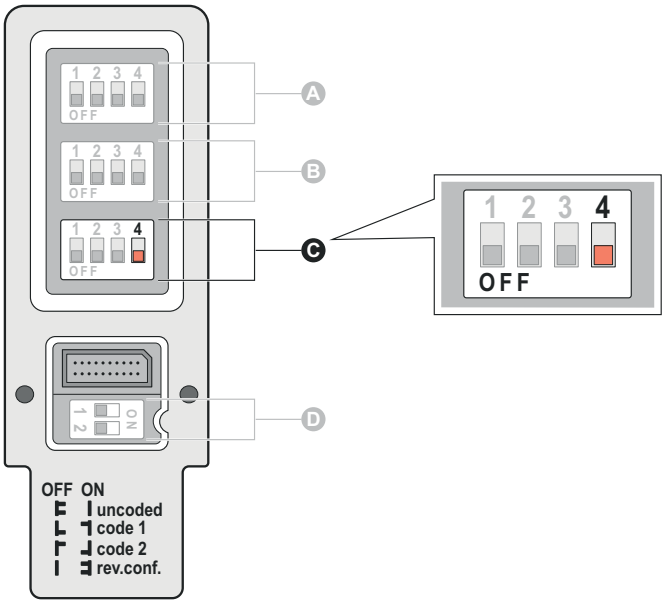



*Figure 63: DIP switch for parity on SP2 system plug*

**Prerequisites**

- SP2 system plug

**Approach**

► Add the DIP switches of rows A, B and C that are set to On.
  - If the sum of the DIP switches is even, keep the setting of DIP switch 4.
  - If the sum of the DIP switches is uneven, change the setting of DIP switch 4.

**Example**

On one device, partial blanking was configured based on cross-muting and the beam coding (code 1). DIP switch 4 is in the OFF status.

► Sum of the DIP switches (rows A to C), that are set to ON = 2.
DIP switches 1 and 2 (row D) for the beam coding are not included.
✓ The sum of the DIP switch is even.
► The setting of DIP switch 4 (row C) stays in the OFF status.

## 7.12 Configuring the restart interlock

**Prerequisites**

- A reset pushbutton is connected
- The device is not in the Override or Override required state

**Approach**

**NOTE**
Skip the first and second steps if the device is already in configuration mode.

1. Disconnect the device from the voltage supply.
2. Switch on the voltage supply, then continue with the next step within 30 s.
If more than 30 s elapses, start with step 1 again.
3. Press the reset pushbutton for between 1 and 3 s, then release it
If the reset pushbutton is pressed for more than 3 s, start with step 1 again.

✓ The device is in configuration mode, the field indicator flashes green.

✓ Diagnostic LED 4 flashes white and signals that the restart interlock has been configured.
✓ The restart interlock is configured. The reset pushbutton must remain at the connection to which it was connected during configuration.
4. When using the device in a cascade, wait until all receivers concerned indicate the correct cascade configuration. In a cascade, diagnostic LED 2 flashes.
5. Disconnect the device from the voltage supply.
✓ The device can now be put into operation.

To deactivate the restart interlock, reset the receiver to the factory settings.

**Complementary information**

The restart interlock is deactivated on delivery.

If muting is configured, the same button is used for reset and override. The button must be connected to the 8-pin system connection.

When the restart interlock is configured, the application diagnostic output located on the same plug connector as the reset pushbutton signals when the reset pushbutton needs to be pressed. The application diagnostic output signals “Reset required” and periodically switches between HIGH and LOW so that any suitable lamp that is connected flashes.

If you connect an unconfigured device in a cascade to a device for which a restart interlock has been configured, the unconfigured device adopts the restart interlock configuration of the configured device.

**Further topics**

- "Factory settings", page 93
- "Restart interlock", page 56

## 7.13 Configuring external device monitoring (EDM)

**Prerequisites**

- External device monitoring can only be configured when the wiring has been correctly performed.

**Approach**

1. Disconnect the device from the voltage supply.
2. Make sure that the wiring has been performed correctly and that the contactor has dropped out so that 24 V are present at the EDM input when the device is switched on
3. Switch on the voltage supply.
✓ The device is in configuration mode, the field indicator flashes green.
✓ Diagnostic LED 1 flashes white and signals that the external device monitoring has been configured.
✓ External device monitoring is active. The wiring must remain at the connection to which it was connected during configuration.
4. If necessary: to configure the restart interlock, press the reset pushbutton for between 1 and 3 s, then release it. If diagnostic LED 4 flashes white, the restart interlock has been configured.
5. When using the device in a cascade, wait until all receivers concerned indicate the correct cascade configuration. In a cascade, diagnostic LED 2 flashes.
6. Disconnect the device from the voltage supply.
✓ The device can now be put into operation.

To deactivate the external device monitoring, reset the receiver to the factory settings.

### Complementary information

External device monitoring is deactivated on delivery.

### Further topics

- "External device monitoring (EDM)", page 57
- "Factory settings", page 93

## 7.14 Configuring application diagnostic output

### Overview

The application diagnostic outputs are configured automatically:

**The following signals can be output over the application diagnostic output:**

- Reset required
- Weak signal
- Ignored object
- Muting status
- Override required
- Valid object for Smart Box Detection

A signal can be output on both the system and extension connections.

*Table 39: Output signals on the system connection and extension connection*

| Configured function | Output signal on the application diagnostic output of the system connection | Output signal on the application diagnostic output of the extension connection |
|---|---|---|
| Not configured (factory settings) | Weak signal [1] | Weak signal [1] |
| Reduced resolution | Ignored object [2] | Weak signal [1] |
| Restart interlock with reset pushbutton on the system connection | Reset required | Weak signal [1] |
| Restart interlock with reset pushbutton on the extension connection | Weak signal [1] or ignored object [2] | Reset required |
| Muting on In1 and In2 | Override required | Muting condition or override required |
| Muting on In2 and In4 | Muting status or override required | Muting status or override required |
| Muting on In1 and In2 and restart interlock with reset pushbutton on the system connection | Reset required or override required | Muting status or reset required or override required |
| Muting on In2 and In4 and restart interlock with reset pushbutton on the system connection | Muting status or reset required or override required | Muting status or reset required or override required |
| Smart Box Detection | Override required | Valid object required for Smart Box Detection or Override |
| Smart Box Detection and restart interlock with reset pushbutton on the system connection | Reset required or override required | Valid object for Smart Box Detection or Reset required or Override required |

| Configured function | Output signal on the application diagnostic output of the system connection | Output signal on the application diagnostic output of the extension connection |
|---|---|---|
| Smart Box Detection and restart interlock with reset pushbutton on the extension connection | Valid object for Smart Box Detection or Reset required or Override required | Reset required |

1) A weak signal is only signaled if no other output signal is configured on the respective application diagnostic output.
2) An ignored object is only signaled if neither a restart interlock on the system connection nor muting are configured.

#### Weak signal

If the receiver of the ESPE is receiving a weak signal from the sender, e.g., because the sender and receiver are not correctly aligned to each other, or because the front screen is contaminated, the application diagnostic output signals the weak signal with the HIGH state.

#### Ignored object

As long as the ESPE detects an object that is smaller than the reduced resolution set, the application diagnostic output gives the ignored object signal.

#### Reset required

When the protective field of the ESPE is free again after an interruption, the application diagnostic output located on the same plug connector as the reset pushbutton signals that the reset pushbutton needs to be pressed. The application diagnostic output signals that reset is required and periodically switches between HIGH and LOW so that any suitable lamp that is connected flashes.

#### Muting status

If the ESPE is in muting status (the protective function of the ESPE is temporarily bypassed) or in partial suppression status, the application diagnostic output emits a constant signal.

#### Override required

If an error occurs during a valid muting condition or a Smart Box Detection condition is violated, the ESPE changes to the Override required state. The application diagnostic output signals this status by periodically switching on and off.

#### Valid object for Smart Box Detection

If a valid object is detected when Smart Box Detection is configured, the application diagnostic output emits a constant signal.

## 7.15 Configuring cascading

#### Overview

You can use cascading to connect up to 3 safety light curtains, e.g., to provide presence detection. The connected devices act like a long safety light curtain. Only one device, the host, is connected to the control cabinet. The second device, guest 1, is connected to the host. The third device, guest 2, is connected to guest 1.

### Advantages of cascading

**Advantages of cascading:**

- Rapid connection, no additional external circuitry required
- No optical mutual interference between the protective fields within a cascade. Host and guests are operated with the same beam coding.
- Resolution and protective field heights of the individual systems may be different

**NOTE**

If a sender does not have an additional guest connected to it, the extension connection has no function and must be sealed with a protective cap.

### Configuring cascading

No more than 3 systems can be connected in a cascade.

If your devices are in their as-delivered condition or have been reset to the factory settings, you can connect them to each other. The devices recognize automatically that they are part of a cascade.

Devices that are already configured and are to be connected in a cascade must be reset to the factory settings.

Each device detects the number of devices in the cascade when it is switched on. During configuration, the device stores this information in the configuration memory.

**The information stored about the cascade is used to identify inadvertent or intentional changes that could lead to a danger:**

- If fewer devices are detected in the cascade when it is switched on than were stored in the configuration, every device in the cascade switches to the locking state
- If more devices are detected in the cascade when it is switched on than were stored in the configuration, every device in the cascade updates its configuration memory to the new value

### Further topics

- "Connecting preconfigured devices in an existing cascade", page 108

## 7.15.1 Cascading new devices

### Approach

1. Install and wire the devices.
2. Set the DIP switches for the beam coding on the receiver of the host system.
3. Switch on the voltage supply.

✓ The devices are in configuration mode, the field indicator flashes green.

4. Wait until all receivers indicate the correct cascade configuration. In a cascade, diagnostic LED 2 flashes.
5. Wait approx. 3 s longer.
6. Receiver: to configure the restart interlock, press the reset pushbutton for between 1 and 3 s, then release it. Diagnostic LED 4 flashes.
7. Disconnect the devices from the voltage supply.

✓ The cascade can now be put into operation.

### Further topics

- "Configuring beam coding", page 96

### 7.15.2 Connecting a new device in an existing cascade

#### Overview

If you use an unconfigured device to extend a cascade or to replace a (defective) device in a cascade, the unconfigured device adopts the configuration for the restart interlock and external device monitoring from the existing devices.

#### Approach

1. Install and wire the device.
2. Set the DIP switches for the beam coding on the receiver of the host system.
3. Switch on the voltage supply.

✓ The device is in configuration mode, the field indicator flashes green.

4. If the restart interlock or external device monitoring was configured for at least one existing device, the configuration is adopted.
5. Wait until all receivers indicate the correct cascade configuration. In a cascade, diagnostic LED 2 flashes.
6. Wait approx. 3 s longer.
7. Disconnect the device from the voltage supply.

✓ The device can now be put into operation.

#### Further topics

- "Reset to factory settings", page 94
- "Configuring beam coding", page 96

### 7.15.3 Connecting preconfigured devices in an existing cascade

If you use a device that may already have been configured to extend a cascade or to replace a (defective) device in a cascade, reset the device to the factory settings first.

#### Further topics

- "Reset to factory settings", page 94
- "Connecting a new device in an existing cascade", page 108
- "Configuring beam coding", page 96

## 7.16 Status indication on both sides

**The OSSD status and the status of the protective field are indicated via LEDs on the sender and receiver when the following applies:**

- The sender and receiver are connected to one another in the control cabinet
- The sender and receiver are connected to one another via a T-connector

The status information is transferred from the receiver to the sender automatically. A configuration process is not required.

#### Further topics

- "Connection of sender and receiver", page 59

# 8 Commissioning

## 8.1 Safety

### Important information

**DANGER**
Hazard due to lack of effectiveness of the protective device
When changes are made to the machine, the effectiveness of the protective device may be affected unintentionally.

► After every change to the machine and changes to the integration or operational and secondary conditions of the safety light curtain, check the protective device for effectiveness and recommission as specified in this section.

**DANGER**
Dangerous state of the machine

► Make sure that the dangerous state of the machine is (and remains) switched off during mounting, electrical installation, and commissioning.
► Make sure that the outputs of the safety light curtain do not affect the machine during mounting, electrical installation, and commissioning.

**WARNING**
Hazard due to lack of effectiveness of the protective device

► Before commissioning the machine, make sure that the machine is first checked and released by qualified safety personnel.
► Only operate the machine with a perfectly functioning protective device.

### Further topics

- "Minimum distance to reflective surfaces", page 31

## 8.2 Overview

### Prerequisites

- Configuration has been completed correctly
- Mounting has been completed correctly
- Electrical installation has been completed correctly

### Approach

1. If required, connect up to three devices to a cascade.
2. Check the DIP switches at the sender and receiver and set them correctly if required.
3. Fitting the system plug.
4. Switch on the voltage supply.
   - If a change to the configuration is detected or the device has been reset to factory settings, the device is in configuration mode and the field indicator flashes green.
5. Configure the restart interlock if required.
6. Once configuration is complete, briefly interrupt the voltage supply, then switch it back on.
7. If the configuration for the cascading of the restart interlock or external device monitoring needs to be changed, reset the device to factory settings.

8. Once configuration is complete and the device has been restarted, align the sender and receiver.
9. Briefly interrupt the voltage supply, then switch it back on.
10. Check alignment.
11. Check the contactors.

### Further topics

- "Project planning", page 26
- "Mounting", page 76
- "Electrical installation", page 86
- "Configuration", page 91
- "Mounting the system plug", page 76
- "Configuration mode", page 95
- "Configuring the restart interlock", page 103
- "Factory settings", page 93
- "Sender and receiver alignment", page 110
- "Check during commissioning and modifications", page 115

## 8.3 Switching on

### Overview

After switching on, the sender and receiver initialize. All LEDs on the sender and receiver will light up briefly. They then indicate the following information:

- If a change to the configuration is detected or the device has been reset to factory settings, the device is in configuration mode and the field indicator flashes green
- The field indicator and diagnostic LEDs indicate the current configuration
- The receiver indicates the alignment quality using diagnostic LEDs 1, 2, 3 and 4 after a few seconds
  Diagnostic LEDs 5 and 6 light up if the topmost beam (far from system plug) is synchronized. Diagnostic LEDs 7 and 8 light up if the bottommost beam (near system plug) is synchronized.
- In normal operation, the diagnostic LEDs indicate the current configuration. The field indicator, the STATE LED of the sender and the OSSD LED of the receiver also light up.

### Further topics

- "Configuration mode", page 95
- "Indications when switching on", page 124

## 8.4 Sender and receiver alignment

### Overview

Once mounting and electrical installation are complete, the sender and receiver must be aligned with each other.

### Important information

**DANGER**
Dangerous state of the machine

- ► Make sure that the dangerous state of the machine is (and remains) switched off during the alignment process.
- ► Make sure that the outputs of the safety light curtain do not affect the machine during the alignment process.

**NOTE**
While aligning to the indication of the alignment quality, pay attention to the synchronization indication of the topmost and bottommost beam and the bracket with which the sender and receiver are attached.

**Further topics**

- "Alignment with the QuickFix bracket", page 112
- "Alignment with the FlexFix bracket or with the upgrade bracket", page 113
- "Indication of the alignment quality", page 114
- "Diagnostic LEDs", page 124

### 8.4.1 Aligning the sender and receiver

**Important information**

**DANGER**
Dangerous state of the machine

- ► Make sure that the dangerous state of the machine is (and remains) switched off during the alignment process.
- ► Make sure that the outputs of the safety light curtain do not affect the machine during the alignment process.

**DANGER**
Hazard due to lack of effectiveness of the protective device

The integrated laser alignment aid switches the OSSDs to the OFF state.

- ► Make sure that the outputs of the safety light curtain do not have any effect on the machine when the integrated laser alignment aid is activated.
- ► Only use the integrated laser alignment aid to align the safety light curtain.

**DANGER**
Hazard due to lack of effectiveness of the protective device

The integrated laser alignment aid may influence the receiver of a safety light curtain in close proximity. In such cases, the neighboring safety light curtain may not detect persons or parts of the body that require protection.

- ► Perform an alignment or take other measures to ensure that the laser beam only hits the front screen of the relevant receiver. The laser beam must not hit any external receiver should the integrated laser alignment aid be switched on by mistake or due to a fault. An external receiver is a receiver that is not part of the same safety light curtain or same cascade.
- ► During alignment in particular, make sure that the laser beam does not hit any external receiver.

**Prerequisites**

- Sender and receiver have been mounted correctly
- The protective field is free of objects. Neither objects nor body parts (e.g. hand, tool, optional AR60 laser alignment aid) are in the protective field. Otherwise, at most diagnostic LEDs 1 and 2 light up during alignment.

**Approach**

1. Switch on the voltage supply for the safety light curtain.
2. Roughly align the sender with the receiver: Rotate the sender so that it points toward the receiver.
   ► If a pushbutton or switch has been connected for the integrated laser alignment aid, activate the integrated laser alignment aid. Turn the sender so that the beam of the integrated laser alignment aid hits the area of diagnostic LEDs 1, 2, 3 and 4 on the longitudinal axis of the receiver.
3. Align the receiver to the sender: Turn the receiver and pay attention to the indication of the alignment quality and the synchronization status of the topmost and bottommost beams.
   ► If a hand or a tool is in the protective field during the alignment, but diagnostic LEDs 5, 6, 7 and 8 are already lit up, remove the object and continue with step 6.
4. Align the sender to the receiver with more precision as needed and pay attention to the indication of the alignment quality and the synchronization status of the topmost and bottommost beams.
5. Align the receiver to the sender with more precision as needed and pay attention to the indication of the alignment quality and the synchronization status of the topmost and bottommost beams.
6. If at least 3 (better: 4) of diagnostic LEDs 1, 2, 3 and 4 and diagnostic LEDs 5, 6, 7 and 8 light up blue, fix the components in place in the brackets. Torque: 2.5 Nm to 3 Nm.
7. Switch the voltage supply off and then on again.
8. Check diagnostic LEDs 1 to 4 for the alignment quality and diagnostic LEDs 5 to 8 for the synchronization of the topmost and bottommost beams in order to ensure that the components are still aligned with each other correctly.

**NOTE**
If suitable wiring has been established, activate the integrated laser alignment aid.

**Complementary information**

In many cases, the optional AR60 laser alignment aid and the alignment tool available as an accessory can make alignment even easier. If deflector mirrors are installed, the laser alignment aid can be used at the receiver. If there is a large protective field height, it can be used at the top end of the sender and at the receiver.

Since the optional AR60 laser alignment aid is placed with the adapter inside the protective field of the safety light curtain, at most diagnostic LEDs 1 and 2 light up blue and the OSSD LED lights up red. To check whether the OSSD LED of the receiver lights up green and diagnostic LEDs 5,6,7 and 8 light up blue, remove the optional AR60 laser alignment aid.

**Further topics**

- "Indication of the alignment quality", page 114
- "Mounting", page 76
- "Laser alignment aid", page 60

### 8.4.2 Alignment with the QuickFix bracket

**Prerequisites**

- The sender and receiver are mounted with a QuickFix bracket

**Alignment with the QuickFix bracket**

The QuickFix bracket offers you the following adjustment options for aligning the sender and receiver with each other:

- Shift vertically

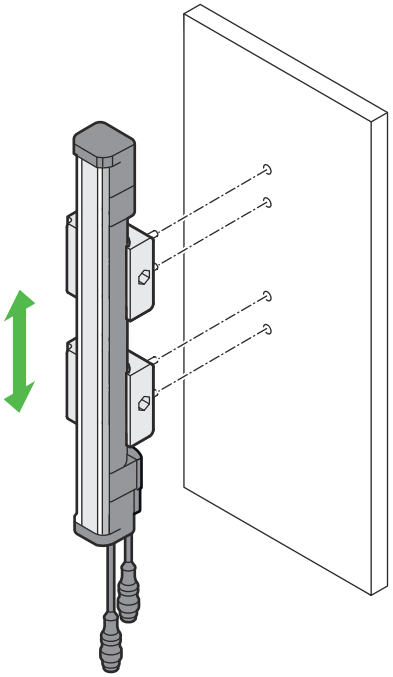


*Figure 64: QuickFix bracket: adjust vertically*

### 8.4.3 Alignment with the FlexFix bracket or with the upgrade bracket

**Prerequisites**

- A FlexFix bracket or upgrade bracket is used to mount the sender and receiver.

**Alignment with the FlexFix bracket or the upgrade bracket**

The FlexFix bracket or upgrade bracket offer you the following adjustment options for aligning the sender and receiver with each other:

- Shift vertically
- Rotate (± 15°)

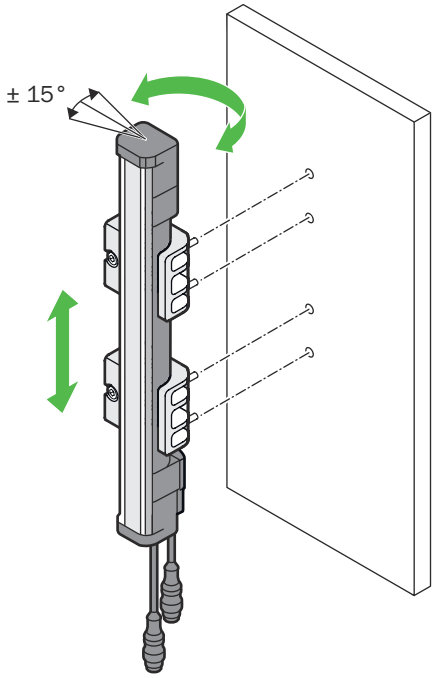



*Figure 65: FlexFix bracket: adjust vertically/rotate*

**NOTE**

Recommendation for aligning a long device so that it rotates uniformly in both brackets:

- ► Grab the alignment device roughly in the center between the two brackets.

### 8.4.4 Indication of the alignment quality

**Important information**

**NOTE**

As soon as the diagnostic LEDs 1, 2 and 3 light up, the alignment is good and availability is stable.

Body parts or objects in the protective field (e.g., hand, tool, AR60 optional laser alignment aid) may impair the indication of the alignment quality (at most diagnostic LEDs 1 and 2 light up).

- ► Ensure that no body parts or objects are in the protective field
  Or
- ► Watch out for diagnostic LEDs 5, 6, 7 and 8. If diagnostic LEDs 5, 6, 7 and 8 light up, the alignment is good and availability is stable.

**Indication of the alignment quality**

Position of LEDs: see "Receiver displays", page 22.

If front screen contamination increases in ongoing operation, the laser alignment aid switches on or the alignment takes longer than 3 seconds, the receiver shows the alignment quality again.

Once the safety light curtain is aligned and the protective field is clear (field indicator: flashing yellow or lit up green), the alignment quality display switches off after a certain period of time.

*Table 40: Indication of the alignment quality*

| LEDs | | | | | | | | Meaning |
|---|---|---|---|---|---|---|---|---|
| Diagnostics LEDs | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
| ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Alignment is inadequate, or the protective field is at least partially interrupted. The receiver cannot synchronize with the sender. |
| ● Blue | ○ | ○ | ○ | | | | | At least one beam is synchronized.<br>However, the alignment is inadequate, or the protective field is at least partially interrupted. |
| ● Blue | ● Blue | ○ | ○ | | | | | The alignment or the signal strength is still not sufficient for stable availability, or the protective field is at least partially interrupted. [1] |
| ● Blue | ● Blue | ● Blue | ○ | | | | | Alignment is good, stable availability. [1] [2] |
| ● Blue | ● Blue | ● Blue | ● Blue | | | | | Alignment is very good. [1] |
| | | | | ● Blue | ● Blue | | | The topmost light beam (far from system plug) is synchronized. |
| | | | | | | ● Blue | ● Blue | The bottommost light beam (near system plug) is synchronized. |

○ LED off. ☼ LED flashes. ● LED illuminates.

1) If external device monitoring is configured and there is an EDM warning, diagnostic LED 1 flashes, while the other diagnostic LEDs 2, 3 and 4 indicate the alignment quality. If there is an error on the reset pushbutton, diagnostic LED 4 flashes, while the other diagnostic LEDs 1, 2 and 3 indicate the alignment quality.

2) If the protective fields are very wide, there is a possibility that diagnostic LED 4 does not light up, even with optimal alignment.

**Further topics**

- "Indications when switching on", page 124

## 8.5 Check during commissioning and modifications

The thorough check is intended to ensure that the safety functions are fulfilling their planned purpose and whether persons are being adequately protected.

► Carry out the checks specified in the test plan of the manufacturer of the machine and the operating entity.

# 9 Operation

## 9.1 Overview

**Information on the status as well as diagnostics and troubleshooting of the safety light curtain can be displayed as follows:**

- Diagnostics LEDs
  Status and fault information, as well as diagnostics data, are displayed directly on the sender and receiver by means of the diagnostics LEDs.
- IO-Link
  Status and error information as well as diagnostics data can be read by means of an IO-link interface.
- NFC
  Status and fault information, as well as diagnostics data, can be read out to an NFC-capable device by means of an integrated NFC interface.

### Complementary information

You can find additional information on IO-Link in the IODD and the SDD for SOPAS ET.

You can find additional information on NFC in the SICK Safety Assistant app.

### Further topics

- "Diagnostic LEDs", page 124

## 9.2 Safety

**DANGER**
Hazard due to lack of effectiveness of the protective device

Persons and parts of the body to be protected may not be recognized in case of non-observance.

- ► Maintenance work, alignment work, fault diagnoses, and any changes to the integration of the protective device in the machine must only be carried out by qualified personnel.
- ► The effectiveness of the protective device must be checked following such work.

**DANGER**
Hazard due to lack of effectiveness of the protective device

Persons and parts of the body to be protected may not be recognized in case of non-observance.

- ► Make sure that the optical properties of the front screens of the sender and receiver are not changed, e.g., by:
  - beading water, mist, frost, or ice formation. If applicable, remove films or other types of contamination, disconnect the voltage supply of the receiver and then switch it back on.
  - Scratches or damage. Replace the device whose front screen is scratched or damaged.
- ► Make sure that all reflective surfaces and objects maintain a minimum distance from the protective field.
- ► Make sure that no dispersive media (e.g., dust, fog, or smoke) are within the calculated minimum distance from the protective field.

**NOTE**
This document does not provide instructions for operating the machine in which the safety light curtain is integrated.

**Further topics**

- "Minimum distance to reflective surfaces", page 31

## 9.3 Regular thorough check

The thorough check is intended to ensure that the safety functions are fulfilling their planned purpose and whether persons are being adequately protected.

► Carry out the checks specified in the test plan of the manufacturer of the machine and the operating entity.

## 9.4 LEDs

### Sender

Position of LEDs: see "Sender displays", page 21.

If the sender and receiver are connected to each other by a cable, the LEDs on the sender indicate the same status as the LEDs on the receiver during normal operation. The STATE LED on the sender adopts the status of the OSSD LED on the receiver.

If the sender and receiver are not connected with each other, the STATE LED on the sender lights up yellow when the sender is in operation and no faults are present.

### Receiver

Position of LEDs: see "Receiver displays", page 22.

*Table 41: LEDs on the receiver during normal operation*

| LEDs | | | | | | | | | End cap with integrated LED | Meaning |
|---|---|---|---|---|---|---|---|---|---|---|
| OSSD | Field | Diagnostics LEDs | | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
| | | ● White | | | | | | | | EDM is configured. |
| | | | ● White | | | | | | | Cascade with 1 or with 2 guest devices is configured. |
| | | | | ● White | | | | | | Beam coding 1 or 2 is configured. |
| | | | | | ● White | | | | | Restart interlock is configured. |
| | | | | | | ● White | | | | Muting or partial blanking is configured.<br>OR<br>Smart Box Detection is configured. |
| | | | | | | | ● White | | | Reduced resolution is configured. |
| | | | | | | | | ● White | | Scanning range adjustment is configured. |

| LEDs | | | | | | | | | | End cap with integrated LED | Meaning |
|---|---|---|---|---|---|---|---|---|---|---|---|
| OSSD | Field | Diagnostics LEDs | | | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | |
| ● Green | ○ | | | | | | | | | ○ | The intelligent presence detection is configured.<br>The guest device is in sleep mode. |
| ● Green | ● Green | | | | | | | | | ● Green | The protective field of the host device is clear.<br>The protective fields of guest devices in a cascade are clear. |
| ● Red | ☀ ☀ Yellow/ green | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ☀ ☀ Yellow/green | Reset of the configuration to factory settings is activated. |
| ● Red | ☀ Green | | | | | | | | | ☀ Green | The device is in configuration mode following a change to the configuration. |
| ● Red | ● Green | | | | | | | | | ● Green | At least 1 protective field of a device in the cascade is interrupted or there is an error at another device.<br>OR<br>The laser alignment aid of the sender is switched on.<br>Its own protective field is clear. |
| ● Red | ● Red | | | | | | | | | ● Red | Its own protective field is interrupted.<br>The indicator is independent of the status of the other protective fields.<br>OR<br>The override pushbutton has just been actuated.<br>OR<br>The protective field is clear.<br>The reset button has just been actuated.<br>OR<br>An error has occurred in Smart Box Detection. The device is not in the Override required state. |

| LEDs | | | | | | | | | | End cap with integrated LED | Meaning |
|---|---|---|---|---|---|---|---|---|---|---|---|
| OSSD | Field | Diagnostics LEDs | | | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | |
| Red | Yellow | | | | | | | | | Yellow | The protective field is clear.<br>Reset required. |
| | | | | | Yellow | | | | | | The reset pushbutton is defective or is being actuated continuously. Check the wiring of the reset pushbutton. |
| Red | | Yellow | | | | | | | | | EDM warning: The EDM input has no signal. Check contactors and wiring. Switch the voltage supply off and back on again. |
| Green | Yellow | | | | | | | | | Yellow | Muting is currently active. The protective field is bypassed.<br>OR<br>Smart Box Detection is configured. A valid object is located in the protective field.<br>OR<br>The device is in the Override state. |
| Green | Yellow | | | | | | White | | | Yellow | Partial blanking is currently active. Only the topmost beam is active. |
| Red | Red | Yellow | Yellow | Yellow | ○ | Yellow | ○ | ○ | ○ | Red | The protective field is interrupted.<br>The muting hold time was exceeded during exit monitoring. The muting sensors are no longer engaged. Make sure that the protective field is clear again. |
| Red | Red/yellow | Yellow | ○ | ○ | ○ | Yellow | ○ | ○ | ○ | Red/yellow | Override required.<br>The protective field is interrupted.<br>The muting hold time was exceeded during exit monitoring. One muting sensor is still engaged. |
| Red | Red/yellow | ○ | ○ | Yellow | ○ | Yellow | ○ | ○ | ○ | Red/yellow | Override required.<br>The protective field is interrupted.<br>The sensor gap monitoring has been exceeded. |

| LEDs | | | | | | | | | | End cap with integrated LED | Meaning |
|---|---|---|---|---|---|---|---|---|---|---|---|
| OSSD | Field | Diagnostics LEDs | | | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | |
| ● Red | ● ● Red/yellow | ● Yellow | ● Yellow | ○ | ○ | ● Yellow | ○ | ○ | ○ | ● ● Red/yellow | Override required.<br>The protective field is interrupted.<br>The topmost beam was interrupted during partial blanking. |
| ● Red | ● ● Red/yellow | ○ | ● Yellow | ● Yellow | ○ | ● Yellow | ○ | ○ | ○ | ● ● Red/yellow | Override required.<br>The protective field is interrupted.<br>At least one muting sensor is engaged.<br>The muting condition is not met. |
| ● Red | ● ● Red/yellow | ● Yellow | ○ | ○ | ● Yellow | ● Yellow | ○ | ○ | ○ | ● ● Red/yellow | Override required.<br>The protective field is interrupted.<br>The total muting time was exceeded. |
| ● Red | ● ● Red/yellow | ○ | ○ | ● Yellow | ● Yellow | ● Yellow | ○ | ○ | ○ | ● ● Red/yellow | Override required.<br>The protective field is interrupted.<br>The concurrence monitoring was exceeded. |
| ● Red | ● ● Yellow/red | ○ | ● Yellow | ○ | ● Yellow | ● Yellow | ○ | ○ | ○ | ● ● Yellow/red | Smart Box Detection<br>Override required.<br>The protective field interruption is not contiguous.<br>OR<br>The protective field interruption does not start at the lowest light beam. |
| ● Red | ● ● Yellow/red | ○ | ○ | ○ | ● Yellow | ● Yellow | ○ | ○ | ○ | ● ● Yellow/red | Smart Box Detection<br>Override required.<br>The object does not have the required minimum height. |
| ● Red | ● ● Yellow/red | ○ | ● Yellow | ○ | ○ | ● Yellow | ○ | ○ | ○ | ● ● Yellow/red | Smart Box Detection<br>Override required.<br>The object is higher than the allowed maximum object height. |
| ● Red | ● ● Yellow/red | ○ | ● Yellow | ● Yellow | ● Yellow | ● Yellow | ○ | ○ | ○ | ● ● Yellow/red | Smart Box Detection<br>Override required.<br>The protective field was interrupted during object entry above the object height detected later. |

| LEDs | | | | | | | | | End cap with integrated LED | Meaning |
|---|---|---|---|---|---|---|---|---|---|---|
| OSSD | Field | Diagnostics LEDs | | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
| ● Red | ☀● Yellow/red | ☀ Yellow | ○ | ☀ Yellow | ○ | ● Yellow | ○ | ○ | ○ | ☀● Yellow/red | Smart Box Detection Override required. The object height is above the object height detected at the beginning. OR The protective field above the detected object is interrupted. |
| ● Red | ☀● Yellow/red | ☀ Yellow | ☀ Yellow | ○ | ☀ Yellow | ● Yellow | ○ | ○ | ○ | ☀● Yellow/red | Smart Box Detection Override required. The total time for Smart Box Detection has been exceeded. The object is still in the protective field. |
| ● Red | ☀● Yellow/red | ☀ Yellow | ☀ Yellow | ☀ Yellow | ☀ Yellow | ● Yellow | ○ | ○ | ○ | ☀● Yellow/red | Smart Box Detection Override required. The protective field is still interrupted after the expected object exit. |
| ● Red | ☀● Yellow/red | | | | | | | | | ☀● Yellow/red | Smart Box Detection Override required. An object has been detected in the protective field while the OSSDs are in the OFF state. |

○ LED off. ☀ LED flashes. ● LED illuminates. Empty cells mean that the LED lights up, flashes, or is off.

If front screen contamination increases in ongoing operation, the laser alignment aid switches on or the alignment takes longer than 3 seconds, the receiver shows the alignment quality again.

**Further topics**

- "Indication of the alignment quality", page 114
- "Diagnostic LEDs", page 124

# 10 Maintenance

## 10.1 Regular cleaning

### Overview

Depending on the ambient conditions of the safety light curtain, the front screens must be cleaned regularly and in the event of contamination. Static charges can cause dust particles to be attracted to the front screen.

The weld spark guard and deflector mirrors must be cleaned regularly and in the event of contamination.

With increasing contamination, the 2 illuminated diagnostic LEDs 1 and 2 indicate that the receiver is receiving a weak signal from the sender. If the device is not cleaned and contamination increases, the safety light curtain switches to the OFF state when contamination is high.

### Important information

**DANGER**
Hazard due to lack of effectiveness of the protective device

Persons and parts of the body to be protected may not be recognized in case of non-observance.

- ► Regularly check the degree of contamination on all components based on the application conditions.
- ► Observe the information concerning test rod testing.

**DANGER**
Hazard due to lack of effectiveness of the protective device

Persons and parts of the body to be protected may not be recognized in case of non-observance.

- ► Make sure that the optical properties of the front screens of the sender and receiver are not changed, e.g., by:
  - beading water, mist, frost, or ice formation. If applicable, remove films or other types of contamination, disconnect the voltage supply of the receiver and then switch it back on.
  - Scratches or damage. Replace the device whose front screen is scratched or damaged.
- ► Make sure that all reflective surfaces and objects maintain a minimum distance from the protective field.
- ► Make sure that no dispersive media (e.g., dust, fog, or smoke) are within the calculated minimum distance from the protective field.

**DANGER**
Hazard due to unexpected starting of the machine

- ► Make sure that the dangerous state of the machine is and remains switched off during the cleaning.
- ► Make sure that the outputs of the safety light curtain do not affect the machine during the cleaning process.

**NOTICE**

- ► Do not use any aggressive cleaning agents.
- ► Do not use any abrasive cleaning agents.
- ► We recommend anti-static cleaning agents.
- ► We recommend the use of anti-static plastic cleaner (SICK part number 5600006) and the SICK lens cloth (SICK part number 4003353).

### Approach

1. Remove dust from the front screen using a soft, clean brush.
2. Then wipe the front screen with a clean, damp cloth.
3. Check the position of the sender and receiver after cleaning.
4. Check the effectiveness of the protective device.

### Further topics

- "Test rod check", page 72
- "Minimum distance to reflective surfaces", page 31

## 10.2 Regular thorough check

The thorough check is intended to ensure that the safety functions are fulfilling their planned purpose and whether persons are being adequately protected.

- ► Carry out the checks specified in the test plan of the manufacturer of the machine and the operating entity.

# 11 Troubleshooting

## 11.1 Overview

**Information on the status as well as diagnostics and troubleshooting of the safety light curtain can be displayed as follows:**

- Diagnostics LEDs
  Status and fault information, as well as diagnostics data, are displayed directly on the sender and receiver by means of the diagnostics LEDs.
- IO-Link
  Status and error information as well as diagnostics data can be read by means of an IO-link interface.
- NFC
  Status and fault information, as well as diagnostics data, can be read out to an NFC-capable device by means of an integrated NFC interface.

### Complementary information

You can find additional information on IO-Link in the IODD and the SDD for SOPAS ET.

You can find additional information on NFC in the SICK Safety Assistant app.

### Further topics

- "Diagnostic LEDs", page 124

## 11.2 Safety

**DANGER**
Hazard due to lack of effectiveness of the protective device

Persons and parts of the body to be protected may not be recognized in case of non-observance.

- ► Immediately shut the machine down if the behavior of the machine cannot be clearly identified.
- ► Immediately put the machine out of operation if you cannot clearly identify or allocate the fault and if you cannot safely remedy the fault.
- ► Secure the machine so that it cannot switch on unintentionally.

**DANGER**
Hazard due to unexpected starting of the machine

- ► When any work is taking place, use the protective device to secure the machine or to ensure that the machine is not switched on unintentionally.

**NOTE**
Additional information on troubleshooting can be found at the responsible SICK subsidiary.

## 11.3 Diagnostic LEDs

### 11.3.1 Indications when switching on

#### Overview

Immediately after switching on, all LEDs on the sender and receiver briefly light up.

Following this, the information below regarding configuration is indicated briefly.

### Sender

Position of LEDs: see "Sender displays", page 21.

*Table 42: Indications on the sender when switching on*

| LEDs | | Meaning |
|---|---|---|
| **STATE** | **Field** | |
| | Yellow, flashes once | Beam coding, code 1 is configured. |
| | Yellow, flashes twice | Beam coding, code 2 is configured. |
| Red | Yellow/green | Reset of the configuration to factory settings is activated, see "Factory settings", page 93. |
| Red | Green | Device is in configuration mode, see "Configuration mode", page 95. |

○ LED off. LED flashes. ● LED illuminates. Empty cells mean that the LED lights up, flashes, or is off.

### Receiver

Position of LEDs: see "Receiver displays", page 22.

*Table 43: Indications on the receiver when switching on*

| LEDs | | | | | | | | | End cap with integrated LED | Meaning |
|---|---|---|---|---|---|---|---|---|---|---|
| **OSSD** | **Field** | **Diagnostic LEDs** | | | | | | | | |
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | |
| | Yellow, flashes once | | | ● White (3 s) | | | | | | Yellow, flashes once | Beam coding, code 1 is configured. |
| | Yellow, flashes twice | | | ● White (3 s) | | | | | | Yellow, flashes twice | Beam coding, code 2 is configured. |
| | | ● White (3 s) | | | | | | | | | External device monitoring (EDM) is configured. |
| | | | ● White (3 s) | | | | | | | | Cascade with 1 guest or 2 guest devices is configured. |
| | | | | | ● White (3 s) | | | | | | Restart interlock is configured. |
| | | | | | | ● White (3 s) | | | | | Muting or partial blanking is configured.<br>OR<br>Smart Box Detection is configured. |
| | | | | | | | ● White (3 s) | | | | Reduced resolution is configured. |

| LEDs | | | | | | | | | End cap with integrated LED | Meaning |
|---|---|---|---|---|---|---|---|---|---|---|
| OSSD | Field | Diagnostic LEDs | | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
| | | | | | | | | ● White (3 s) | | | Scanning range adjustment is configured. |
| ● Red | ☼ Yellow/ green | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ☼ Yellow/green | Reset of the configuration to factory settings is activated, see "Factory settings", page 93. |
| ● Red | ☼ Green | | | | | | | | | ☼ Green | Device is in configuration mode, see "Configuration mode", page 95. When a function is configured, the corresponding diagnostic LED flashes. |

○ LED off. ☼ LED flashes. ● LED illuminates. Empty cells mean that the LED lights up, flashes, or is off.

After the configuration is displayed, diagnostic LEDs 1, 2, 3 and 4 indicate the alignment quality. Additionally, the synchronization status of the topmost and bottommost beams of the safety light curtain are displayed by means of diagnostic LEDs 5 and 6 as well as 7 and 8.

If the configuration was changed, the diagnostic LEDs flash white for 3 s upon activation.

Once the safety light curtain is aligned and the protective field is clear (field indicator: flashing yellow or lit up green), the alignment quality display switches off after a certain period of time.

*Table 44: Indication of the alignment quality*

| LEDs | | | | | | | | Meaning |
|---|---|---|---|---|---|---|---|---|
| Diagnostics LEDs | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
| ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Alignment is inadequate, or the protective field is at least partially interrupted. The receiver cannot synchronize with the sender. |
| ● Blue | ○ | ○ | ○ | | | | | At least one beam is synchronized. However, the alignment is inadequate, or the protective field is at least partially interrupted. |
| ● Blue | ● Blue | ○ | ○ | | | | | The alignment or the signal strength is still not sufficient for stable availability, or the protective field is at least partially interrupted. [1] |
| ● Blue | ● Blue | ● Blue | ○ | | | | | Alignment is good, stable availability. [1] [2] |
| ● Blue | ● Blue | ● Blue | ● Blue | | | | | Alignment is very good. [1] |
| | | | | ● Blue | ● Blue | | | The topmost light beam (far from system plug) is synchronized. |

| LEDs | | | | | | | | Meaning |
|---|---|---|---|---|---|---|---|---|
| Diagnostics LEDs | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
| | | | | | | ● Blue | ● Blue | The bottommost light beam (near system plug) is synchronized. |

○ LED off. ☼ LED flashes. ● LED illuminates.

1) If external device monitoring is configured and there is an EDM warning, diagnostic LED 1 flashes, while the other diagnostic LEDs 2, 3 and 4 indicate the alignment quality. If there is an error on the reset pushbutton, diagnostic LED 4 flashes, while the other diagnostic LEDs 1, 2 and 3 indicate the alignment quality.

2) If the protective fields are very wide, there is a possibility that diagnostic LED 4 does not light up, even with optimal alignment.

### 11.3.2 Status indication

#### Overview

During operation, the status of the safety light curtain is indicated with LEDs.

The information in the tables applies both for single devices and for every device in a cascade.

#### Sender

Position of the LEDs: see "Sender displays", page 21.

If the sender and receiver are connected to each other by a cable, the LEDs on the sender indicate the same status as the LEDs on the receiver during normal operation. The STATE LED on the sender adopts the status of the OSSD LED on the receiver.

If the sender and receiver are not connected with each other, the STATE LED on the sender lights up yellow when the sender is in operation and no faults are present.

#### Receiver

Position of the LEDs: see "Receiver displays", page 22.

*Table 45: LEDs on the receiver during normal operation*

| LEDs | | | | | | | | | | End cap with integrated LED | Meaning |
|---|---|---|---|---|---|---|---|---|---|---|---|
| OSSD | Field | Diagnostics LEDs | | | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | |
| | | ● White | | | | | | | | | EDM is configured. |
| | | | ● White | | | | | | | | Cascade with 1 or with 2 guest devices is configured. |
| | | | | ● White | | | | | | | Beam coding 1 or 2 is configured. |
| | | | | | ● White | | | | | | Restart interlock is configured. |
| | | | | | | ● White | | | | | Muting or partial blanking is configured.<br>OR<br>Smart Box Detection is configured. |
| | | | | | | | ● White | | | | Reduced resolution is configured. |

| LEDs | | | | | | | | | | End cap with integrated LED | Meaning |
|---|---|---|---|---|---|---|---|---|---|---|---|
| OSSD | Field | Diagnostics LEDs | | | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | |
| | | | | | | | | ● White | | | Scanning range adjustment is configured. |
| ● Green | ○ | | | | | | | | | ○ | The intelligent presence detection is configured.<br>The guest device is in sleep mode. |
| ● Green | ● Green | | | | | | | | | ● Green | The protective field of the host device is clear.<br>The protective fields of guest devices in a cascade are clear. |
| ● Red | ☼ ☼ Yellow/green | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ☼ ☼ Yellow/green | Reset of the configuration to factory settings is activated. |
| ● Red | ☼ Green | | | | | | | | | ☼ Green | The device is in configuration mode following a change to the configuration. |
| ● Red | ● Green | | | | | | | | | ● Green | At least 1 protective field of a device in the cascade is interrupted or there is an error at another device.<br>OR<br>The laser alignment aid of the sender is switched on.<br>Its own protective field is clear. |

| LEDs | | | | | | | | | | End cap with integrated LED | Meaning |
|---|---|---|---|---|---|---|---|---|---|---|---|
| OSSD | Field | Diagnostics LEDs | | | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | |
| Red | Red | | | | | | | | | Red | Its own protective field is interrupted. The indicator is independent of the status of the other protective fields.<br>OR<br>The override pushbutton has just been actuated.<br>OR<br>The protective field is clear.<br>The reset button has just been actuated.<br>OR<br>An error has occurred in Smart Box Detection. The device is not in the Override required state. |
| Red | Yellow | | | | | | | | | Yellow | The protective field is clear.<br>Reset required. |
| | | | | | Yellow | | | | | | The reset pushbutton is defective or is being actuated continuously. Check the wiring of the reset pushbutton. |
| Red | | Yellow | | | | | | | | | EDM warning: The EDM input has no signal. Check contactors and wiring. Switch the voltage supply off and back on again. |
| Green | Yellow | | | | | | | | | Yellow | Muting is currently active. The protective field is bypassed.<br>OR<br>Smart Box Detection is configured. A valid object is located in the protective field.<br>OR<br>The device is in the Override state. |
| Green | Yellow | | | | | | White | | | Yellow | Partial blanking is currently active. Only the topmost beam is active. |

| LEDs | | | | | | | | | End cap with integrated LED | Meaning |
|---|---|---|---|---|---|---|---|---|---|---|
| OSSD | Field | Diagnostics LEDs | | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
| ● Red | ● Red | ☀ Yellow | ☀ Yellow | ☀ Yellow | ○ | ● Yellow | ○ | ○ | ○ | ● Red | The protective field is interrupted.<br>The muting hold time was exceeded during exit monitoring. The muting sensors are no longer engaged.<br>Make sure that the protective field is clear again. |
| ● Red | ☀ Red/yellow | ☀ Yellow | ○ | ○ | ○ | ● Yellow | ○ | ○ | ○ | ☀ Red/yellow | Override required.<br>The protective field is interrupted.<br>The muting hold time was exceeded during exit monitoring. One muting sensor is still engaged. |
| ● Red | ☀ Red/yellow | ○ | ○ | ☀ Yellow | ○ | ● Yellow | ○ | ○ | ○ | ☀ Red/yellow | Override required.<br>The protective field is interrupted.<br>The sensor gap monitoring has been exceeded. |
| ● Red | ☀ Red/yellow | ☀ Yellow | ☀ Yellow | ○ | ○ | ● Yellow | ○ | ○ | ○ | ☀ Red/yellow | Override required.<br>The protective field is interrupted.<br>The topmost beam was interrupted during partial blanking. |
| ● Red | ☀ Red/yellow | ○ | ☀ Yellow | ☀ Yellow | ○ | ● Yellow | ○ | ○ | ○ | ☀ Red/yellow | Override required.<br>The protective field is interrupted.<br>At least one muting sensor is engaged.<br>The muting condition is not met. |
| ● Red | ☀ Red/yellow | ☀ Yellow | ○ | ○ | ☀ Yellow | ● Yellow | ○ | ○ | ○ | ☀ Red/yellow | Override required.<br>The protective field is interrupted.<br>The total muting time was exceeded. |
| ● Red | ☀ Red/yellow | ○ | ○ | ☀ Yellow | ☀ Yellow | ● Yellow | ○ | ○ | ○ | ☀ Red/yellow | Override required.<br>The protective field is interrupted.<br>The concurrence monitoring was exceeded. |

| LEDs | | | | | | | | | | End cap with integrated LED | Meaning |
|---|---|---|---|---|---|---|---|---|---|---|---|
| OSSD | Field | Diagnostics LEDs | | | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | |
| Red | Yellow/red | ○ | Yellow | ○ | Yellow | Yellow | ○ | ○ | ○ | Yellow/red | Smart Box Detection Override required. The protective field interruption is not contiguous. OR The protective field interruption does not start at the lowest light beam. |
| Red | Yellow/red | ○ | ○ | ○ | Yellow | Yellow | ○ | ○ | ○ | Yellow/red | Smart Box Detection Override required. The object does not have the required minimum height. |
| Red | Yellow/red | ○ | Yellow | ○ | ○ | Yellow | ○ | ○ | ○ | Yellow/red | Smart Box Detection Override required. The object is higher than the allowed maximum object height. |
| Red | Yellow/red | ○ | Yellow | Yellow | Yellow | Yellow | ○ | ○ | ○ | Yellow/red | Smart Box Detection Override required. The protective field was interrupted during object entry above the object height detected later. |
| Red | Yellow/red | Yellow | ○ | Yellow | ○ | Yellow | ○ | ○ | ○ | Yellow/red | Smart Box Detection Override required. The object height is above the object height detected at the beginning. OR The protective field above the detected object is interrupted. |
| Red | Yellow/red | Yellow | Yellow | ○ | Yellow | Yellow | ○ | ○ | ○ | Yellow/red | Smart Box Detection Override required. The total time for Smart Box Detection has been exceeded. The object is still in the protective field. |
| Red | Yellow/red | Yellow | Yellow | Yellow | Yellow | Yellow | ○ | ○ | ○ | Yellow/red | Smart Box Detection Override required. The protective field is still interrupted after the expected object exit. |

| LEDs | | | | | | | | | | End cap with integrated LED | Meaning |
|---|---|---|---|---|---|---|---|---|---|---|---|
| OSSD | Field | Diagnostics LEDs | | | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | |
| ● Red | ☀ ● Yellow/red | | | | | | | | | ☀ ● Yellow/red | Smart Box Detection Override required. An object has been detected in the protective field while the OSSDs are in the OFF state. |

○ LED off. ☀ LED flashes. ● LED illuminates. Empty cells mean that the LED lights up, flashes, or is off.

If front screen contamination increases in ongoing operation, the laser alignment aid switches on or the alignment takes longer than 3 seconds, the receiver shows the alignment quality again.

**Further topics**

- "Indication of the alignment quality", page 114

### 11.3.3 Fault indicators

**Overview**

In the event of a fault, the type of fault is indicated by the LED display on the sender or receiver.

The information in the tables applies both for single devices and for every device in a cascade.

When a device in a cascade shows a fault, the displays of the other devices in the cascade must also be observed. The fault cause is only shown on the device in which it occurs.

**Sender**

Position of the LEDs: see "Sender displays", page 21.

*Table 46: Fault indication on the sender*

| LEDs | | Possible cause | Troubleshooting |
|---|---|---|---|
| STATE | Field | | |
| ● Yellow | ○ | Normal operation, no cable connection between sender and receiver. [1)] | – |
| ● Yellow | ● Red | Fault in the voltage supply. | ► Check the voltage supply, see "Technical data", page 140.<br>► Switch the voltage supply off and back on again.<br>► If the fault persists, replace the sender, see "Ordering information", page 150. |
| ☀ Yellow | ● Red | The sender identified an internal fault. | ► Switch the voltage supply off and back on again.<br>► If the fault persists, replace the sender, see "Ordering information", page 150. |
| ● Red | ☀ ● Yellow/green | Reset of the configuration to factory settings is activated. | For additional information: see "Factory settings", page 93. |

| LEDs | | Possible cause | Troubleshooting |
|---|---|---|---|
| STATE | Field | | |
| ● Red | ☀ Green | The device is in configuration mode following a change to the configuration. | For additional information: see "Configuration mode", page 95. |
| ☀ Green | ☀ Red | A problem occurred when resetting the configuration to factory settings. | ► Restart configuration, see "Factory settings", page 93. |
| ● Red | ☀ Yellow | Incompatible device detected. | 1. For a sender-receiver connection, ensure that the sender and receiver devices are compatible, see "Connection of sender and receiver", page 59.<br>2. Ensure that the connected sender devices as well as the connected receiver devices in a cascade are compatible, see "Cascading", page 61. |
| ● Red | ☀ Red | Communication fault between the senders in a cascade. | ► Check the cascade wiring.<br>► Switch the voltage supply off and back on again. |
| ☀ Red | ☀ Red | Different beam codings in a cascade or impermissible cascade structure. | ► Check the configuration of the devices, particularly the beam coding.<br>► If the sender and receiver are connected to each other, also check the configuration of the receiver.<br>► Switch the voltage supply off and back on again. |
| ○ | ☀ Red | The voltage is or was too high when operating the sender. | ► Check the voltage supply, see "Technical data", page 140.<br>► Replace the sender, see "Ordering information", page 150. |

○ LED off. ☀ LED flashes. ● LED illuminates.

1) If the sender and receiver are connected by a cable, the LEDs on the sender indicate the same status as the LEDs on the receiver during normal operation. The STATE LED on the sender adopts the status of the OSSD LED on the receiver.

### Receiver

Position of the LEDs: see "Receiver displays", page 22.

*Table 47: Fault indication on the receiver*

| LEDs | | | | | | | | | | End cap with integrated LED | Possible cause | Troubleshooting |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OSSD | Field | Diagnostics LEDs | | | | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | |
| ● Red | ☀ Red | ☀ Red | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ☀ Red | An internal fault has occurred. | ► Switch the voltage supply off and back on again.<br>► If the fault continues to persist, replace the receiver, see "Ordering information", page 150. |

| LEDs | | | | | | | | | | End cap with integrated LED | Possible cause | Troubleshooting |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OSSD | Field | Diagnostics LEDs | | | | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | |
| ● Red | ☀ Red | ○ | ☀ Red | ○ | ○ | ○ | ○ | ○ | ○ | ☀ Red | Fault in the voltage supply. | ► Check the voltage supply and the power supply unit, see "Technical data", page 140.<br>► Switch the voltage supply off and back on again.<br>► If the fault continues to persist, replace the receiver, see "Ordering information", page 150. |
| ● Red | ☀ Red | ○ | ☀ Red | ○ | ☀ Red | ○ | ○ | ○ | ○ | ☀ Red | Permanent error in the voltage supply. | ► Replace device, see "Ordering information", page 150. |
| ● Red | ☀ Red | ○ | ☀ Red | ☀ Red | ☀ Red | ○ | ○ | ○ | ○ | ☀ Red | General error in the configuration. | ► Check configuration settings including the permitted combination of functions.<br>► Make sure that the correct system plug is used.<br>► Reset device to factory settings. |
| ● Red | ☀ Red | ○ | ○ | ☀ Red | ☀ Red | ○ | ○ | ○ | ○ | ☀ Red | Parity faulty. | ► Check setting of the parity DIP switch.<br>► Switch the voltage supply off and then on again |
| ● Red | ☀ Red | ○ | ○ | ☀ Red | ○ | ○ | ○ | ○ | ○ | ☀ Red | The receiver has recognized beams from several senders. | ► Check the distance to senders of the same design.<br>► Check the beam coding of the receiver and systems in close proximity.<br>► Ensure that beams from another sender cannot hit the receiver. (Exception: One of the two systems uses code 1 and the other uses code 2), see "Protection against interference from systems in close proximity to each other", page 33.<br>► Switch the voltage supply off and back on again. |

| LEDs | | | | | | | | | End cap with integrated LED | Possible cause | Troubleshooting |
|---|---|---|---|---|---|---|---|---|---|---|---|
| OSSD | Field | Diagnostics LEDs | | | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | |
| ● Red | ☀ Red | ○ | ○ | ○ | ☀ Red | ○ | ○ | ○ | ○ | ☀ Red | A wiring fault has been identified at the OSSDs or at an input.<br>E.g., at an OSSD: overvoltage, short-circuit, cross-circuit, permissible load capacity exceeded.<br>E.g., at an input: invalid signal, unexpected signal. | ► Check the system wiring for a fault. Make sure that the OSSDs and inputs have been wired correctly, see "Integration in electrical control", page 54.<br>► Switch the voltage supply off and back on again.<br>► If the fault continues to persist, replace the defective components, see "Ordering information", page 150. |
| ● Red | ☀ Red | ○ | ☀ Red | ☀ Red | ○ | ○ | ○ | ○ | ○ | ☀ Red | A wiring fault has been detected. | ► Check the system wiring for a fault.<br>► Make sure that the IO-link interface was wired correctly.<br>► Switch the voltage supply off and back on again. |
| ● Red | ☀ Red | ☀ Red | ○ | ☀ Red | ○ | ○ | ○ | ○ | ○ | ☀ Red | Incompatible device detected. | ► For a sender-receiver connection, ensure that the sender and receiver devices are compatible, see "Connection of sender and receiver", page 59.<br>► Ensure that the connected sender devices as well as the connected receiver devices in a cascade are compatible, see "Cascading", page 61. |
| ● Red | | ☀ Yellow | | | | | | | | | EDM warning (only if the external device monitoring function is active): The OSSDs have constantly been in the OFF state since the safety light curtain was switched on and no signal is present at the EDM input. | Normally, this message is displayed only briefly after switching on and goes out as soon as the voltage supply for the auxiliary contacts is established at the contactors. If the message is displayed for longer:<br>► Check the contactors.<br>► Check the wiring of the contactors.<br>► Switch the voltage supply off and back on again. |

| LEDs | | | | | | | | | | End cap with integrated LED | Possible cause | Troubleshooting |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OSSD | Field | Diagnostics LEDs | | | | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | |
| ● Red | ● Red | ● Red | ○ | ○ | ○ | ● Red | ○ | ○ | ○ | ● Red | EDM fault (only if the external device monitoring function is active):<br>The status of the EDM input has not changed within 300 ms following a change to the OSSD status.<br>OR<br>The status of the EDM input has changed even though the OSSD status has not. | ► Check the contactors.<br>► Check the wiring of the contactors.<br>► Switch the voltage supply off and back on again. |
| ● Red | ● Yellow/green | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ● ● Yellow/green | Reset of the configuration to factory settings is activated. | For additional information: see "Factory settings", page 93. |
| ● Red | ● Green | | | | | | | | | ● Green | The device is in configuration mode following a change to the configuration. | For additional information: see "Configuration mode", page 95. |
| ● Red | ● Red | ● Red | ● Red | ● Red | ● Red | ○ | ○ | ○ | ○ | ● Red | A problem occurred when resetting the configuration to factory settings. | ► Restart configuration, see "Factory settings", page 93. |
| ● Red | ● Red | ○ | ● Red | ○ | ○ | ○ | ○ | ○ | ● Red | ● Red | Incompatible configuration of the devices in a host–guest cascade. | ► Check the configuration of the devices. If the sender and receiver are connected to each other, also check the configuration of the sender.<br>► Switch the voltage supply off and back on again.<br>► If the fault persists, reset the device to factory settings and reconfigure it, see "Configuration", page 91. |

| LEDs | | | | | | | | | | End cap with integrated LED | Possible cause | Troubleshooting |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OSSD | Field | Diagnostics LEDs | | | | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | |
| ● Red | ☀ Red | ○ | ● Red | ○ | ○ | ○ | ○ | ☀ Red | ○ | ☀ Red | Incompatible configuration of the devices in a host–guest–guest cascade. | ▶ Check the configuration of the devices. If the sender and receiver are connected to each other, also check the configuration of the sender.<br>▶ Switch the voltage supply off and back on again.<br>▶ If the fault persists, reset the device to factory settings and reconfigure it, see "Configuration", page 91. |
| ● Red | ☀ Red | ○ | ● Red | ○ | ○ | ○ | ○ | ☀ Red | ☀ Red | ☀ Red | Communication fault between the receivers in a host–guest cascade. | ▶ Check the cascade wiring.<br>▶ Switch the voltage supply off and back on again.<br>▶ If the fault continues to persist, replace the defective components, see "Ordering information", page 150. |
| ● Red | ☀ Red | ○ | ● Red | ○ | ○ | ○ | ☀ Red | ○ | ○ | ☀ Red | Communication fault between the receivers in a host–guest–guest cascade. | ▶ Check the cascade wiring.<br>▶ Switch the voltage supply off and back on again.<br>▶ If the fault continues to persist, replace the defective components, see "Ordering information", page 150. |
| ● Red | ☀ Red | ☀ Red | ○ | ○ | ○ | ● Red | ○ | ○ | ○ | ☀ Red | The number of permitted override states for muting or Smart Box Detection has been exceeded. | ▶ Switch the voltage supply off and back on again. |
| | | | | | ☀ Yellow | | | | | | Reset pushbutton fault. | ▶ Check that the reset pushbutton is working. The reset pushbutton may be defective or is being pressed continuously.<br>▶ Check the wiring of the reset pushbutton. |

| LEDs | | | | | | | | | End cap with integrated LED | Possible cause | Troubleshooting |
|---|---|---|---|---|---|---|---|---|---|---|---|
| OSSD | Field | Diagnostics LEDs | | | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | |
| ● Red | ☀ Red | ○ | ○ | ● Red | ○ | ○ | ○ | ○ | ☀ Red | ☀ Red | Different beam coding on the sender and receiver detected. | ► Configure sender and receiver with the same beam coding.<br>► Switch the voltage supply off and back on again. |

○ LED off. ☀ LED flashes. ● LED illuminates. Empty cells mean that the LED lights up, flashes, or is off.

# 12 Decommissioning

## 12.1 Disposal

### Approach

► Always dispose of unusable devices in accordance with national waste disposal regulations.

### Complementary information

SICK will be glad to help you dispose of these devices on request.

# 13 Technical data

## 13.1 Version numbers and range of functions

The table below describes the technical changes or extensions of the range of function made to the device in the course of product maintenance.

The range of functions refers only to the receiver. The sender is not affected and is compatible with the change states.

We use a three-digit version number to identify the different change states of the range of function.

**The range of functions of the device is found at the following locations:**

- On the type label: Field under the “Type” field
- In the SICK Safety Assistant app via NFC: Technical data or report
- Via IO-Link in the ISDU of the respective device (DeviceIdentRH, DeviceIdentRG1, DeviceIdentRG2): "HcsvMajor", "HcsvMinor", "HcsvRelease" field
- Via IO-Link in the SDD for SOPAS ET

*Table 48: Version numbers and range of functions*

| Version number | Amendments and new functions | Additional information |
|---|---|---|
| No version number (1.0.0) | Initial device version | |
| 1.1.0 | Supplement to the Smart Box Detectionfunction | "Smart Box Detection", page 47 |

## 13.2 Data sheet

*Table 49: General system data*

| | Minimum | Typical | Maximum |
|---|---|---|---|
| Protective field height, depending on type | 300 mm to 2,100 mm, 150-mm steps | | |
| Resolution (detection capability), depending on type | 14 mm or 30 mm | | |
| Protective field width [1) 2) 3)] | | | |
| Resolution 14 mm | 0.15 m ... 16 m | 0.15 m ... 20 m | |
| Resolution 14 mm (sender with small scanning range) | 0.15 m ... 2 m | 0.15 m ... 2.5 m | |
| Resolution 30 mm | 0 m ... 24 m | 0 ... 30 m | |
| Protection class [4)] | III (IEC 61140) | | |
| Enclosure rating [5)] | IP65 (IEC 60529)<br>IP67 (IEC 60529) | | |
| Supply voltage $U_V$ at the device [6) 7) 8)] | 19.2 V | 24 V | 28.8 V |
| Residual ripple [9)] | | | ± 10% |
| Synchronization | Optical | | |
| Typ (IEC 61496) | Type 4 | | |
| Category (ISO 13849) | Category 4 | | |
| Performance level (ISO 13849) [10)] | PL e | | |
| Safety integrity level (IEC 61508) [10)] | SIL 3 | | |
| Safety integrity level (IEC 62061) [10)] | SIL 3 | | |
| $PFH_D$ (mean probability of a dangerous failure per hour) [11)] | | | |

| | Minimum | Typical | Maximum |
|---|---|---|---|
| Single system | 1,53 x $10^{-8}$ | | |
| Cascade with one guest | 3,05 x $10^{-8}$ | | |
| Cascade with two guest devices | 4,56 x $10^{-8}$ | | |
| $T_M$ (mission time) | 20 years (ISO 13849-1) | | |
| Safe status when a fault occurs | At least one OSSD is in the OFF state. | | |
| Number of beams in a cascade [12) 13)] | | | |
| Beam coding uncoded | | | No limit |
| Beam coding: code 1 or code 2 | | | 375 beams |
| Test rod speed at which the test rod is reliably detected [14)] | 0 m/s ... 1.6 m/s | | |
| **Time monitoring for muting** | | | |
| Sensor gap monitoring (muting sensor and ESPE) | | 0.5 s | |
| Muting end delay | | 0.2 s | |
| Total time end of muting by ESPE [15)] | | 0.7 s | |
| Muting hold time | | 4 s | |
| Concurrence monitoring | | 24 h | |
| Total muting time | | 24 h | |
| **Smart Box Detection** | | | |
| Object speed | 0.1 m/s | | 1 m/s |
| Object height $h_{box}$ | 134 mm | | (Protective field height - 54) mm |
| Object width $w_{box}$ | min. 10 mm ... 100 mm [16)] | | |
| Upper and lower object edge tolerance $dY_{box}$ (object height) | min. 10 mm | | |
| Lateral object edge tolerance $dX_{box}$ (object width) [17)] | min. 6 mm ... 60 mm (uncoded system)<br>min. 4 mm ... 40 mm (coded system) | | |
| Minimum distance from objects | min. 10 mm ... 100 mm [16)] | | |
| Total Smart Box Detection time | | 24 h | |

1) If the protective fields are very wide, there is a possibility that all four diagnostic LEDs 1, 2, 3 and 4 will not light up even when alignment is optimal.
2) The minimum scanning range specifies a range in which a function is guaranteed to operate correctly and safely under industrial conditions. A sufficient level of signal reserve to ensure very high availability is included in the calculation.
3) The typical scanning range specifies a range in which the safety light curtain operates correctly and safely under industrial conditions. The level of signal reserve is enough to ensure high availability.
4) SELV/PELV safety extra-low voltage.
5) The specified enclosure rating only applies if the system plug is fitted and the protective cover for the DIP switches, which is attached to the SP2 system plug, is securely closed.
6) The external voltage supply must be capable of bridging a brief power failure of 20 ms as specified in IEC 60204-1. Suitable power supply units are available as accessories from SICK.
7) A fuse rated maximum 4 A shall be installed in the 24 V DC power supply circuit to the device in order to limit the available current.
8) All inputs of the safety light curtain must be supplied by the same voltage supply. If the sender and receiver are connected to each other, they must be supplied by the same voltage supply.
9) Within the limits of $U_V$.
10) For more detailed information on the exact configuration of your machine, please contact your relevant SICK subsidiary.
11) The values apply for an installation height of up to 2,000 m above sea level. Additional information can be found at your SICK subsidiary.
12) The maximum permissible current must be observed.
13) Calculation of number of beams:

- Resolution 14 mm: protective field height/mm / 10 (example, protective field height 2,100 mm: 2,100/10 = 210 beams)
- Resolution 30 mm: protective field height/mm / 25 (example, protective field height 2,100 mm: 2,100/25 = 84 beams)

14) Direction of movement and axis of the test rod perpendicular to the protective field.
15) The values apply for the time from when the ESPE becomes clear until the termination of muting and contain a sensor gap monitoring ESPE and a muting end delay.
16) The values depend on the object speed.
17) The values depend on the object speed and the set beam coding.

*Table 50: Mechanical data*

| | **deTec4** |
|---|---|
| Housing material | Aluminum extruded profile |
| Front screen material | PMMA |

*Table 51: Technical data for sender*

| | **Minimum** | **Typical** | **Maximum** |
|---|---|---|---|
| Wavelength of sender | | Near-infrared (NIR), invisible | |
| Weight | Depending on the protective field height, see "Table of weights", page 148 | | |
| **Laser alignment aid** | | | |
| Wavelength | | 650 nm (red) | |
| Average output power | | | 390 µW |
| Laser class | 1 | | |
| **Laser alignment aid switch input (In1)** | | | |
| Input voltage HIGH (active) | 13 V | 24 V | 30 V |
| Input current HIGH | 2 mA | 5 mA | 7 mA |
| Input voltage LOW (deactivated) | -3 V | 0 V | 3 V |
| Input current LOW | -0.1 mA | 0 mA | 0.5 mA |
| **Laser alignment aid pushbutton input (In2)** | | | |
| Input voltage HIGH (active) | 13 V | 24 V | 30 V |
| Input current HIGH | 2 mA | 5 mA | 7 mA |
| Input voltage LOW (deactivated) | -3 V | 0 V | 3 V |
| Input current LOW | -0.1 mA | 0 mA | 0.5 mA |
| Control switch actuation time | 50 ms | | |
| **Permissible cable resistance** [1] | | | |
| Supply cable [2] | | | 2.5 Ω |
| Cable between host and guest | | | 1 Ω |

1) Limit the individual conductor resistance to the specified values to ensure that the light curtain functions correctly. (Also observe IEC 60204-1.)
The specified values apply to the total resistance of each wire including contact and connector resistances.
2) If a T-connector is used, the specified values apply to the resistance of the entire cable from the system connection of the device to the connection in the control cabinet.
For a cascade, the specified values apply to the resistance of the entire cable from the system connection of the last guest device to the connection in the control cabinet.

*Table 52: Technical data for receiver*

| | **Minimum** | **Typical** | **Maximum** |
|---|---|---|---|
| **Output signal switching devices (OSSDs)** | 2 PNP semiconductors, short-circuit protected [1], cross-circuit monitored | | |
| Response time | "Response time", page 145 | | |

| | Minimum | Typical | Maximum |
|---|---|---|---|
| Duration of OFF state | 100 ms | | |
| Switch-on delay | | 3 × response time | |
| ON state, switching voltage HIGH ($U_{rms}$) [2] | $U_V$ – 2.25 V | 24 V | $U_V$ |
| OFF state, switching voltage LOW [2] [3] | 0 V | 0 V | 2.0 V |
| Current-carrying capacity of the OSSDs | | | 500 mA each |
| Leakage current of the OSSDs | | | 2 mA each |
| Load capacity | | | 2.2 µF |
| Load inductance | | | 2.2 H |
| **Test pulse data** [4] | | | |
| Test pulse width | | 150 µs | 300 µs |
| Test pulse rate | 3 $s^{-1}$ | 5 $s^{-1}$ | 10 $s^{-1}$ |
| Discrepancy time (time offset between switching of OSSD2 and OSSD1) | | | 1 ms |
| **Inputs** | | | |
| Input voltage HIGH (active) [2] | 11 V | 24 V | 30 V |
| Input current HIGH | 6 mA | 10 mA | 20 mA |
| Input voltage LOW (deactivated) [2] | –3 V | 0 V | 5 V |
| Input current LOW | -2.5 mA | 0 mA | 0.5 mA |
| **External device monitoring input (EDM)** | | | |
| Connected contactors | | | |
| Permissible dropout time | | | 300 ms |
| Permissible pull in time | | | 300 ms |
| **Reset pushbutton input (RES)** | | | |
| Control switch actuation time | 50 ms | | |
| **Muting signal 1 and muting signal 2 inputs (In1, In2, In4)** | | | |
| Input filter | | 50 ms | |
| **Muting sensors** | | | |
| Output type | PNP switching | | |
| Current consumption of a muting sensor | | | 50 mA |
| Supply voltage | $U_v$ – 1 V | | $U_v$ |
| **Application diagnostic output (ADO)** | PNP semiconductor, short-circuit protected [1] | | |
| Output voltage HIGH (active) | $U_V$ – 3 V | | |
| Output voltage LOW (deactivated) | | High resistance | |
| Output current HIGH (active) | | | 100 mA |
| **Permissible cable resistance** [5] | | | |
| Supply cable [6] [7] | | | 1 Ω [8] |
| Cable between host and guest | | | 1 Ω |
| Cable between OSSD and load | | | 2.5 Ω |

| | Minimum | Typical | Maximum |
|---|---|---|---|
| All additional wires at the system connection and extension connection [6] | | | 2.5 Ω |

1) Applies to the voltage range between -30 V and +30 V.
2) According to IEC 61131-2.
3) The specified values are the switching voltage supplied by the safety light curtain. If higher voltages are implanted externally, the maximum value of 2.0 V can be exceeded.
4) When active, the outputs are tested cyclically (brief LOW). When selecting the downstream controllers, make sure that the test pulses do not result in deactivation when using the above parameters.
5) Limit the individual conductor resistance to the specified values to ensure that the light curtain functions correctly, particularly that a cross-circuit between the outputs is safely detected. (Also observe IEC 60204-1.)
The specified values apply to the total resistance of each wire including contact and connector resistances.
6) If a T-connector is used, the specified values apply to the resistance of the entire cable from the system connection of the device to the connection in the control cabinet.
For a cascade, the specified values apply to the resistance of the entire cable from the system connection of the last guest device to the connection in the control cabinet.
7) The supply cable must not be used to connect other loads with the exception of the senders.
8) If a T-connector is used and the input current is greater than 1.2 A, the conductor resistance must not exceed 0.5 Ω.
If the device is not used in a cascade, a T-connector is not used, and no inductive OSSD loads (e.g., contactors) are applied, the conductor resistance must not exceed 2 Ω.

*Table 53: Operating data*

| | Minimum | Typical | Maximum |
|---|---|---|---|
| System connection | 5-pin M12 male connector<br>8-pin M12 male connector | | |
| Length of cable | 200 mm | | |
| Cable diameter | 5 mm | | |
| Cable material of the system or extension connection | PUR | | |
| Extension connection | Optional, female connector, M12, 5-pin | | |
| Lengths of cable for connecting cables and in cascades | "Length of cable", page 146 | | |
| Lengths of cable for other cables on the extension connection | | | 10 m |
| Ambient operating temperature [1] [2] [3] | -30 °C | | +55 °C |
| Air humidity (non-condensing) | 15% | | 95% |
| Storage temperature | -30 °C | | +70 °C |
| Housing cross-section | 31 mm × 34 mm, plus bracket, see "Dimensional drawings", page 149 | | |
| Vibration resistance [4] | 5 ... 150 Hz, 3,5 mm / 1 g (EN 60068-2-6) | | |
| Shock resistance [5] | 15 g / 6 ms (EN 60068-2-27) | | |
| Class | 3M4 (IEC TR 60721-4-3) | | |
| EMC | According to IEC 61496-1, IEC 61000-6-2, IEC 61000-6-4 | | |

1) The temperature difference between sender and receiver must not exceed 25 K.
2) The cable belonging to the device incl. the associated connection plug must not be flexibly mounted under –25 °C.
3) Maximum ambient operating temperature over 1,000 m above sea level: +50 °C.
Maximum ambient operating temperature over 2,000 m above sea level: +45 °C.
4) Test conditions per axis: 1 octave/minute, 20 sweeps.
5) Test conditions per axis: 200 shocks.

## 13.3 Response time

**NOTE**
If the Smart Box Detection function is configured on the receiver with a 14 mm resolution, a response time of 80 ms applies regardless of the protective field height and beam coding.

*Table 54: Response time of a single device* [1)]

| Protective field height in mm | Response time in ms | | | |
|---|---|---|---|---|
| | Resolution 14 mm | | Resolution 30 mm | |
| | Uncoded | Code 1 or code 2 | Uncoded | Code 1 or code 2 |
| 300 | 11 | 16 | 9 | 12 |
| 450 | 12 | 19 | 10 | 14 |
| 600 | 13 | 22 | 10 | 15 |
| 750 | 13 | 25 | 11 | 16 |
| 900 | 14 | 28 | 11 | 17 |
| 1050 | 15 | 31 | 11 | 18 |
| 1200 | 16 | 34 | 12 | 20 |
| 1350 | 17 | 37 | 12 | 21 |
| 1500 | 18 | 40 | 13 | 22 |
| 1650 | 19 | 42 | 13 | 23 |
| 1800 | 20 | 45 | 13 | 24 |
| 1950 | 21 | 48 | 14 | 25 |
| 2100 | 22 | 51 | 14 | 27 |

1) The values apply to individual devices without configured Smart Box Detection.

### Response time for a cascade of two devices

► Calculate the response time of the cascade using the following formula:
$t_C = t_H + t_{G1}$
Where:
- $t_C$ = response time of the cascade
- $t_H$ = response time of the device used as host, see table 54 [6)]
- $t_{G1}$ = response time of the device used as guest 1, see table 54

### Response time for a cascade of three devices

► Calculate the response time of the cascade using the following formula:
$t_C = t_H + t_{G1} + t_{G2}$
Where:
- $t_C$ = response time of the cascade
- $t_H$ = response time of the device used as host, see table 54 [7)]
- $t_{G1}$ = response time of the device used as guest 1, see table 54 [8)]
- $t_{G2}$ = response time of the device used as guest 2, see table 54

6) The response time of the host within the cascade is $t_C$ - 6 ms.
7) The response time of the host within the cascade is $t_C$ – 12 ms.
8) The response time of guest 1 within the cascade is $t_C$ – 6 ms.

## 13.4 Power consumption

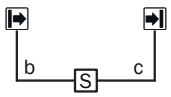
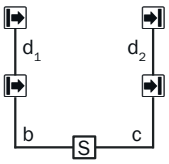
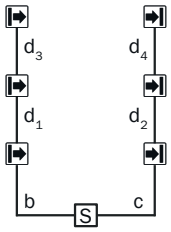
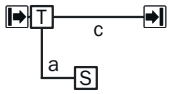
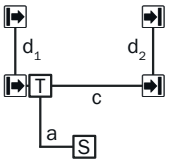
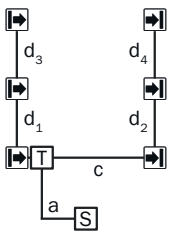
*Table 55: Power consumption for sender and receiver*

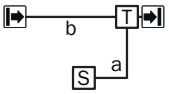
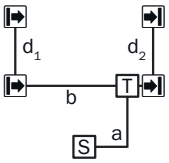
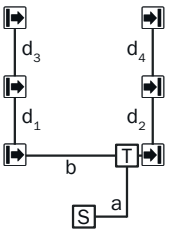
| Protective field height in mm | Typical power consumption for sender in W | | Typical power consumption for receiver in W [1] [2] | |
|---|---|---|---|---|
| | Resolution 14 mm | Resolution 30 mm | Resolution 14 mm | Resolution 30 mm |
| 300 | 1.42 | 1.23 | 3.43 | 3.23 |
| 450 | 1.51 | 1.31 | 3.60 | 3.30 |
| 600 | 1.60 | 1.38 | 3.76 | 3.36 |
| 750 | 1.68 | 1.45 | 3.93 | 3.43 |
| 900 | 1.77 | 1.53 | 4.09 | 3.50 |
| 1050 | 1.85 | 1.60 | 4.26 | 3.56 |
| 1200 | 1.94 | 1.68 | 4.42 | 3.63 |
| 1350 | 2.03 | 1.75 | 4.59 | 3.69 |
| 1500 | 2.11 | 1.82 | 4.75 | 3.76 |
| 1650 | 2.20 | 1.90 | 4.92 | 3.83 |
| 1800 | 2.29 | 1.97 | 5.08 | 3.89 |
| 1950 | 2.37 | 2.05 | 5.25 | 3.96 |
| 2100 | 2.46 | 2.12 | 5.41 | 4.02 |

1) Power discharged again via the OSSDs depending on the connected OSSD load must be added to the table values.
2) The power consumption increases by 0.5 W with the use of a receiver with integrated LED.

## 13.5 Length of cable

*Table 56: Maximum lengths of cable for wire cross-section 0.34 mm², copper wire*

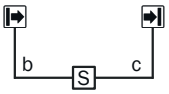
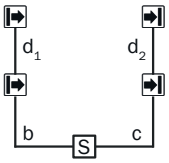
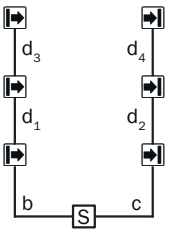
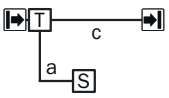
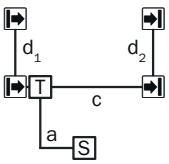
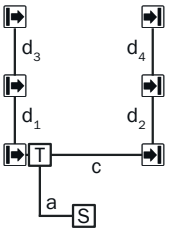
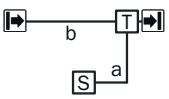
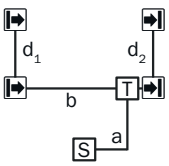
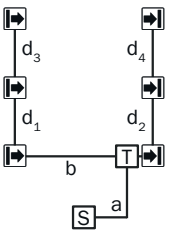
| | Single system | Cascade with 1 guest | Cascade with 2 guest devices |
|---|---|---|---|
| Separate connecting cables for sender and receiver |  b ≤ 50 m c ≤ 15 m |  b ≤ 25 m c ≤ 15 m $d_1$, $d_2$ ≤ 5 m |  b ≤ 15 m c ≤ 10 m $d_1$, $d_2$, $d_3$, $d_4$ ≤ 5 m |
| Connection of sender and receiver via T-connector on the sender |  a ≤ 7 m c ≤ 10 m |  a ≤ 5 m c ≤ 7 m $d_1$ ≤ 10 m $d_2$ ≤ 5 m |  a, c ≤ 5 m $d_1$, $d_2$, $d_3$, $d_4$ ≤ 3 m |

| | Single system | Cascade with 1 guest | Cascade with 2 guest devices |
|---|---|---|---|
| Connection of sender and receiver via T-connector on the receiver |  a, b ≤ 12 m |  a, b ≤ 7 m<br>$d_1$, $d_2$ ≤ 3 m |  a ≤ 5 m b ≤ 7 m<br>$d_1$, $d_2$, $d_3$, $d_4$ ≤ 3 m |

**S** Control cabinet with safety relay or safety controller

**T** T-connector

*Table 57: Maximum lengths of cable for wire cross-section 0.25 mm², copper wire*

| | Single system | Cascade with 1 guest | Cascade with 2 guest devices |
|---|---|---|---|
| Separate connecting cables for sender and receiver |  b ≤ 35 m c ≤ 12 m |  b ≤ 15 m c ≤ 10 m<br>$d_1$, $d_2$ ≤ 5 m |  b ≤ 10 m c ≤ 8 m<br>$d_1$, $d_2$, $d_3$, $d_4$ ≤ 2 m |
| Connection of sender and receiver via T-connector on the sender |  a ≤ 5 m c ≤ 7 m |  a, c ≤ 5 m<br>$d_1$ ≤ 10 m $d_2$ ≤ 5 m |  a, c ≤ 3 m<br>$d_1$, $d_2$, $d_3$, $d_4$ ≤ 3 m |
| Connection of sender and receiver via T-connector on the receiver |  a ≤ 8 m b ≤ 10 m |  a, b ≤ 5 m<br>$d_1$, $d_2$ ≤ 3 m |  a ≤ 3 m b ≤ 5 m<br>$d_1$, $d_2$, $d_3$, $d_4$ ≤ 3 m |

**S** Control cabinet with safety relay or safety controller

**T** T-connector

## 13.6 Table of weights

*Table 58: Weight of sender and receiver*

| Protective field height in mm | Weight in g [1] | |
|---|---|---|
| | Sender | Receiver |
| 300 | 230 | 240 |
| 450 | 370 | 380 |
| 600 | 510 | 520 |
| 750 | 640 | 650 |
| 900 | 780 | 790 |
| 1050 | 910 | 920 |
| 1200 | 1050 | 1060 |
| 1350 | 1180 | 1190 |
| 1500 | 1320 | 1330 |
| 1650 | 1450 | 1460 |
| 1800 | 1590 | 1600 |
| 1950 | 1730 | 1740 |
| 2100 | 1860 | 1870 |

[1] Tolerance: ± 50 g.

## 13.7 Dimensional drawings

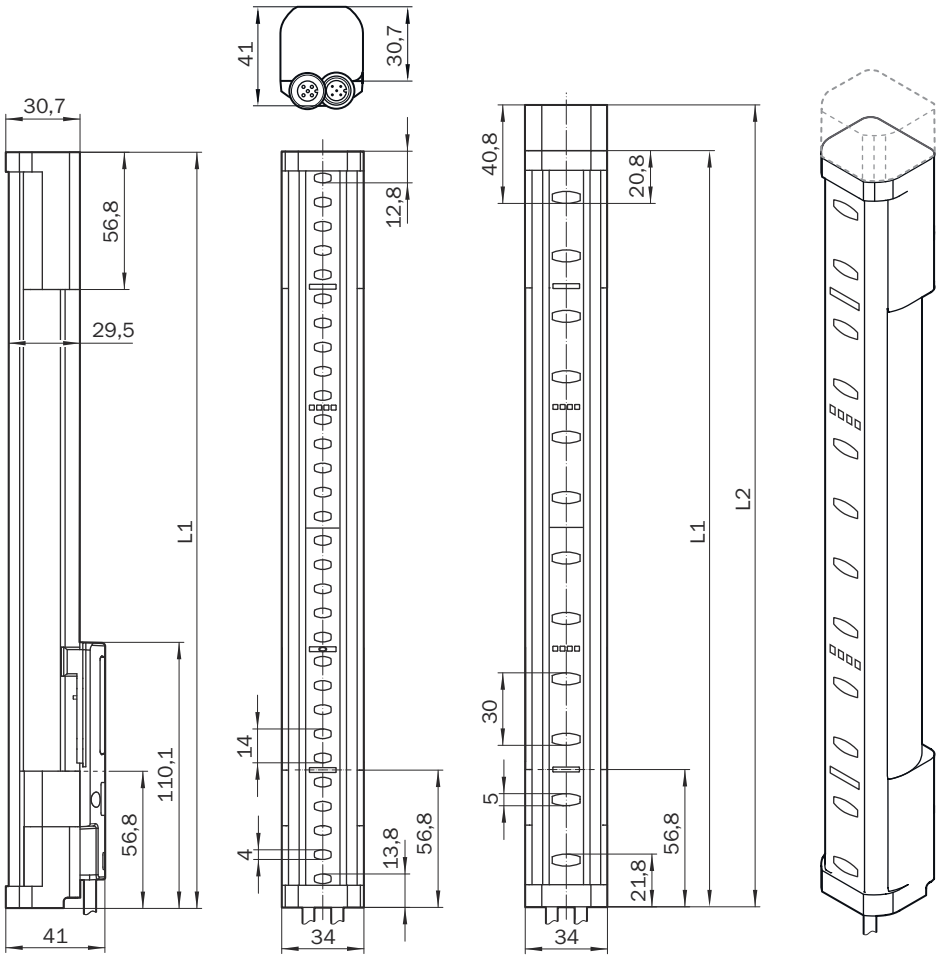



*Figure 66: Dimensional drawing of sender and receiver*

*Table 59: Dimensions based on the protective field height, sender and receiver*

| Protective field height, nominal in mm | Protective field height, effective = dimension L1 in mm | Dimension L2 in mm |
|---|---|---|
| 300 | 313 | 332 |
| 450 | 463 | 482 |
| 600 | 613 | 632 |
| 750 | 763 | 782 |
| 900 | 913 | 932 |
| 1050 | 1063 | 1082 |
| 1200 | 1213 | 1232 |
| 1350 | 1362 | 1382 |
| 1500 | 1512 | 1531 |
| 1650 | 1662 | 1681 |
| 1800 | 1812 | 1831 |
| 1950 | 1962 | 1981 |
| 2100 | 2112 | 2131 |

# 14 Ordering information

## 14.1 Scope of delivery

**Scope of delivery, sender**

- Sender

**Scope of delivery, receiver**

- Receiver
- Test rod with diameter corresponding to the resolution of the safety light curtain
- Safety note
- Mounting instructions
- Operating instructions for download: www.sick.com

## 14.2 Ordering information

*Table 60: SP1 system plug ordering information*

| Connection type | Type codes | Part number |
|---|---|---|
| System connection (M12, 5-pin) | 1000 | 2076832 |
| System connection (M12, 8-pin) | 1200 | 2076834 |
| System connection (M12, 5-pin) and extension connection (M12, 5-pin) | 1100 | 2076833 |
| System connection (M12, 8-pin) and extension connection (M12, 5-pin) | 1300 | 2076835 |

*Table 61: SP2 system plug ordering information*

| Connection type | Type codes | Part number |
|---|---|---|
| System connection (M12, 5-pin) | 2000 | 2093097 |
| System connection (M12, 8-pin) | 2200 | 2093099 |
| System connection (M12, 5-pin) and extension connection (M12, 5-pin) | 2100 | 2093098 |
| System connection (M12, 8-pin) and extension connection (M12, 5-pin) | 2300 | 2093100 |

*Table 62: Ordering information for deTec4, resolution 14 mm*

| Protective field height in mm | Sender | | Receiver | |
|---|---|---|---|---|
| | Part number | Type codes | Part number | Type code |
| 300 | 1220084 | C4P-SA03011A00 | 1220097 | C4P-EA03011C00 |
| 450 | 1220085 | C4P-SA04511A00 | 1220098 | C4P-EA04511C00 |
| 600 | 1220086 | C4P-SA06011A00 | 1220099 | C4P-EA06011C00 |
| 750 | 1220087 | C4P-SA07511A00 | 1220100 | C4P-EA07511C00 |
| 900 | 1220088 | C4P-SA09011A00 | 1220101 | C4P-EA09011C00 |
| 1050 | 1220089 | C4P-SA10511A00 | 1220102 | C4P-EA10511C00 |
| 1200 | 1220090 | C4P-SA12011A00 | 1220103 | C4P-EA12011C00 |
| 1350 | 1220091 | C4P-SA13511A00 | 1220104 | C4P-EA13511C00 |
| 1500 | 1220092 | C4P-SA15011A00 | 1220105 | C4P-EA15011C00 |
| 1650 | 1220093 | C4P-SA16511A00 | 1220106 | C4P-EA16511C00 |
| 1800 | 1220094 | C4P-SA18011A00 | 1220121 | C4P-EA18011C00 |
| 1950 | 1220095 | C4P-SA19511A00 | 1220107 | C4P-EA19511C00 |

| Protective field height in mm | Sender | | Receiver | |
|---|---|---|---|---|
| | Part number | Type codes | Part number | Type code |
| 2100 | 1220096 | C4P-SA21011A00 | 1220108 | C4P-EA21011C00 |

*Table 63: Ordering information deTec4 for 30 mm resolution*

| Protective field height in mm | Sender | | Receiver | |
|---|---|---|---|---|
| | Part number | Type code | Part number | Type code |
| 300 | 1220123 | C4P-SA03031A00 | 1220137 | C4P-EA03031C00 |
| 450 | 1220124 | C4P-SA04531A00 | 1220138 | C4P-EA04531C00 |
| 600 | 1220125 | C4P-SA06031A00 | 1220139 | C4P-EA06031C00 |
| 750 | 1220126 | C4P-SA07531A00 | 1220140 | C4P-EA07531C00 |
| 900 | 1220127 | C4P-SA09031A00 | 1220141 | C4P-EA09031C00 |
| 1050 | 1220128 | C4P-SA10531A00 | 1220142 | C4P-EA10531C00 |
| 1200 | 1220129 | C4P-SA12031A00 | 1220143 | C4P-EA12031C00 |
| 1350 | 1220130 | C4P-SA13531A00 | 1220144 | C4P-EA13531C00 |
| 1500 | 1220131 | C4P-SA15031A00 | 1220145 | C4P-EA15031C00 |
| 1650 | 1220132 | C4P-SA16531A00 | 1220146 | C4P-EA16531C00 |
| 1800 | 1220134 | C4P-SA18031A00 | 1220147 | C4P-EA18031C00 |
| 1950 | 1220135 | C4P-SA19531A00 | 1220148 | C4P-EA19531C00 |
| 2100 | 1220136 | C4P-SA21031A00 | 1220149 | C4P-EA21031C00 |

### Sender with small scanning range

*Table 64: Ordering information for deTec4, resolution 14 mm*

| Protective field height in mm | Sender | |
|---|---|---|
| | Part number | Type codes |
| 300 | 1220639 | C4P-SA03011C00 |
| 450 | 1220640 | C4P-SA04511C00 |
| 600 | 1220641 | C4P-SA06011C00 |
| 750 | 1220642 | C4P-SA07511C00 |
| 900 | 1220643 | C4P-SA09011C00 |
| 1050 | 1220644 | C4P-SA10511C00 |
| 1200 | 1220645 | C4P-SA12011C00 |
| 1350 | 1220646 | C4P-SA13511C00 |
| 1500 | 1220647 | C4P-SA15011C00 |
| 1650 | 1220648 | C4P-SA16511C00 |
| 1800 | 1220649 | C4P-SA18011C00 |
| 1950 | 1220650 | C4P-SA19511C00 |
| 2100 | 1220651 | C4P-SA21011C00 |

### Receiver with integrated LED

*Table 65: Ordering information for deTec4, resolution 14 mm*

| Protective field height in mm | Receiver | |
|---|---|---|
| | Part number | Type codes |
| 300 | 1220109 | C4P-EA03011D00 |
| 450 | 1220110 | C4P-EA04511D00 |
| 600 | 1220111 | C4P-EA06011D00 |
| 750 | 1220112 | C4P-EA07511D00 |
| 900 | 1220113 | C4P-EA09011D00 |
| 1050 | 1220114 | C4P-EA10511D00 |

| Protective field height in mm | Receiver | |
|---|---|---|
| | Part number | Type codes |
| 1200 | 1220115 | C4P-EA12011D00 |
| 1350 | 1220116 | C4P-EA13511D00 |
| 1500 | 1220117 | C4P-EA15011D00 |
| 1650 | 1220118 | C4P-EA16511D00 |
| 1800 | 1220122 | C4P-EA18011D00 |
| 1950 | 1220119 | C4P-EA19511D00 |
| 2100 | 1220120 | C4P-EA21011D00 |

*Table 66: Ordering information for deTec4, resolution 30 mm*

| Protective field height in mm | Receiver | |
|---|---|---|
| | Part number | Type codes |
| 300 | 1220150 | C4P-EA03031D00 |
| 450 | 1220151 | C4P-EA04531D00 |
| 600 | 1220152 | C4P-EA06031D00 |
| 750 | 1220153 | C4P-EA07531D00 |
| 900 | 1220154 | C4P-EA09031D00 |
| 1050 | 1220155 | C4P-EA10531D00 |
| 1200 | 1220156 | C4P-EA12031D00 |
| 1350 | 1220157 | C4P-EA13531D00 |
| 1500 | 1220158 | C4P-EA15031D00 |
| 1650 | 1220159 | C4P-EA16531D00 |
| 1800 | 1220160 | C4P-EA18031D00 |
| 1950 | 1220161 | C4P-EA19531D00 |
| 2100 | 1220162 | C4P-EA21031D00 |

# 15 Accessories

## 15.1 Brackets

*Table 67: Brackets ordering information*

| Part | Type code | Part number |
|---|---|---|
| QuickFix bracket (2x) | BEF-3SHABPKU2 | 2066048 |
| QuickFix bracket (4x) | BEF-3SHABPKU4 | 2098710 |
| FlexFix bracket (2x) | BEF-1SHABPKU2 | 2098709 |
| FlexFix bracket (4x) | BEF-1SHABPKU4 | 2066614 |
| FlexFix mounting kit (2x FlexFix brackets, alignment tool, and assembly materials for installation in device columns) | BEF-1SHABBKU2 | 2073543 |
| Replacement bracket (kit with 4 brackets, mounting kit for replacement of swivel mount brackets 2019649 and 2019659 or side bracket 2019506 with the FlexFix bracket when using the wells provided) | BEF-1SHABS004 | 2100345 |
| Replacement bracket (kit with 4 brackets, mounting kit for replacement of swivel mount brackets 2030510 or side bracket 2019506 with the FlexFix bracket when using the wells provided) | BEF-1SHABU004 | 2099282 |

### QuickFix bracket

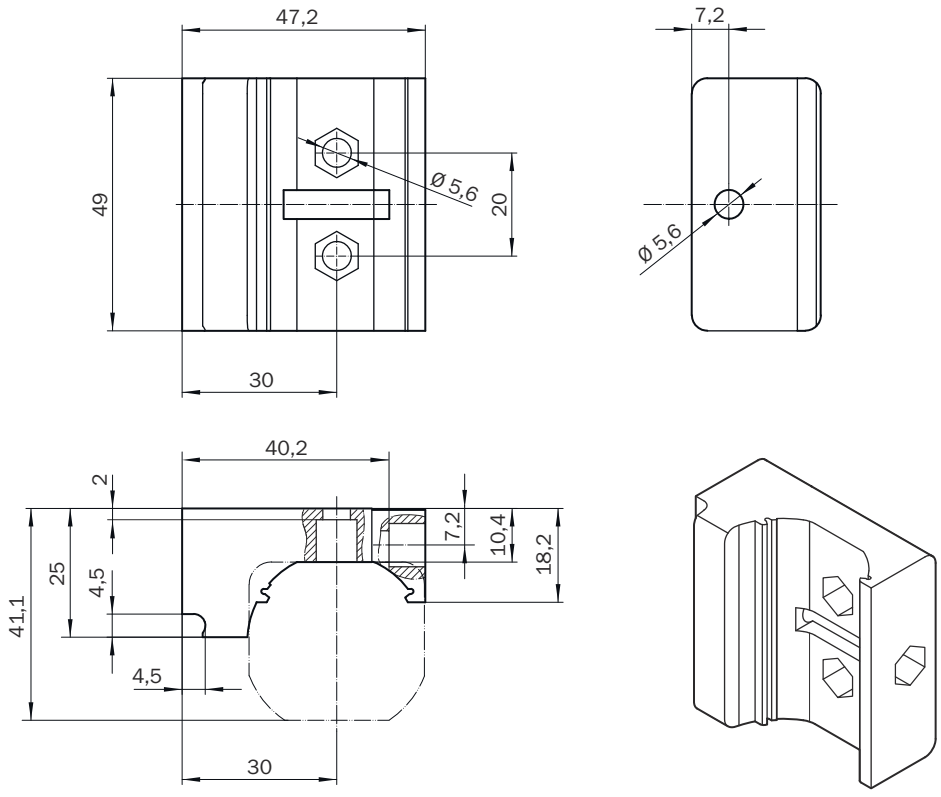



*Figure 67: Dimensional drawing of the QuickFix bracket*

**FlexFix bracket**

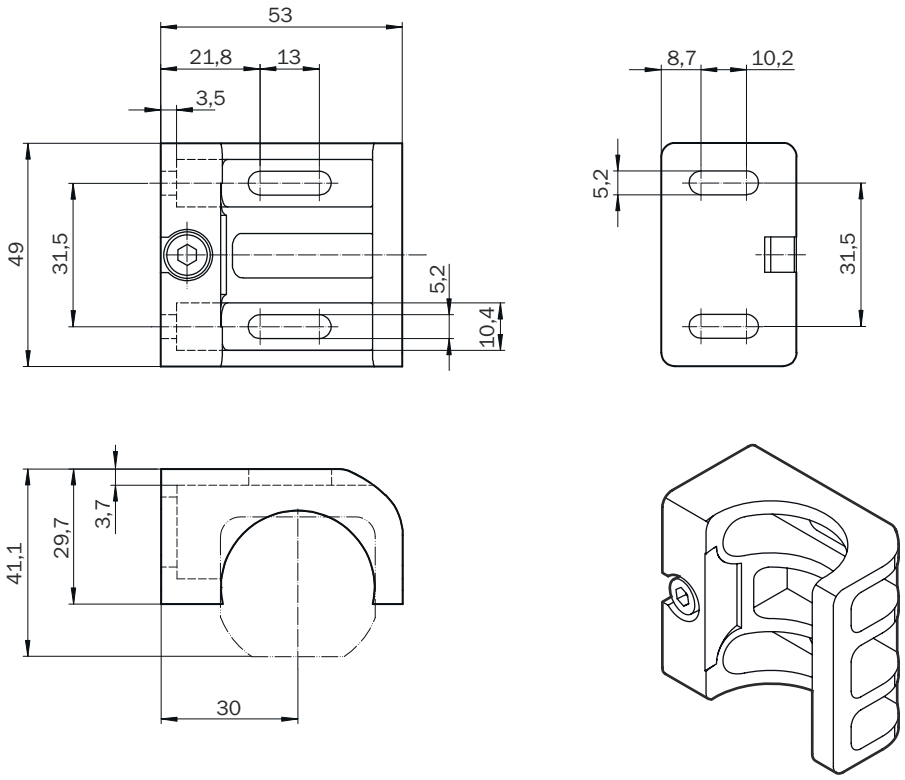



*Figure 68: Dimensional drawing of the FlexFix bracket*

## 15.2 Mounting accessories

*Table 68: Mounting accessories ordering information*

| Part | Part number |
|---|---|
| Alignment tool | 4084133 |

## 15.3 Weld spark guard

### Overview

The weld spark guard can be used to protect the front screen of the safety light curtain.

The weld spark guard reduces the scanning range of the system by 15%.

### Important information

**DANGER**

Hazard due to lack of effectiveness of the protective device

The weld spark guard may influence the optical properties of the safety light curtain, leading to persons or body parts that should be protected being reflected and therefore remaining undetected.

► Make sure that all reflective surfaces and objects maintain the correct minimum distance from the protective field.

### Differing minimum distance to reflective surfaces for devices with a resolution of 30 mm with weld spark guard

If a device with a resolution of 30 mm is used with the weld spark guard, the following applies in contrast to other specifications in order to determine the minimum distance from reflective surfaces:

1. Determine the distance D between sender and receiver in meters (m).
2. Read the minimum distance a in millimeters (mm) in the graph or calculate it based on the respective formula (see table 69).

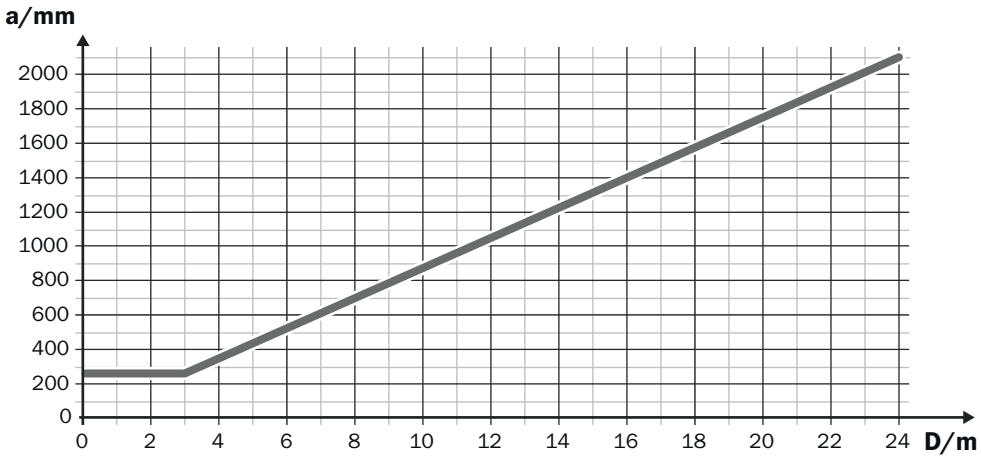



*Figure 69: Diagram minimum distance to reflective surfaces for devices with a resolution of 30 mm with weld spark guard*

*Table 69: Formula for calculating the minimum distance to reflective surfaces for devices with a resolution of 30 mm with weld spark guard*

| Distance D between sender and receiver in m | Calculation of the minimum distance (a) from reflective surfaces in mm |
|---|---|
| D ≤ 3 m | a = 262 mm |
| D > 3 m | a = tan (5°) × 1000 mm/m × D = 87,49 × 1 mm/m × D |

If a device (resolution 30 mm) is used with a dynamic protective field width (large area: 0 m to 24 m) and with the weld spark guard, the following – in contrast with other specifications – is used to determine the minimum distance from reflective surfaces:

1. Determine the distance D between sender and receiver in meters (m).
2. For a distance D > 6 m, calculate minimum distance a in millimeters (mm) based on the corresponding formula (see table 70).

*Table 70: Formula for calculating the minimum distance to reflective surfaces for devices (resolution 30 mm) with a dynamic protective field width (large area) with weld spark guard*

| Distance D between sender and receiver in m | Calculation of the minimum distance (a) from reflective surfaces in mm |
|---|---|
| D ≤ 6 m | a = 524 mm |
| D > 6 m | a = tan (5°) × 1,000 mm/m × D = 87.49 × 1 mm/m × D |

*Table 71: Weld spark guard ordering information*

| Part | Part number |
|---|---|
| Weld spark guard | 2069268 |

### Mounting

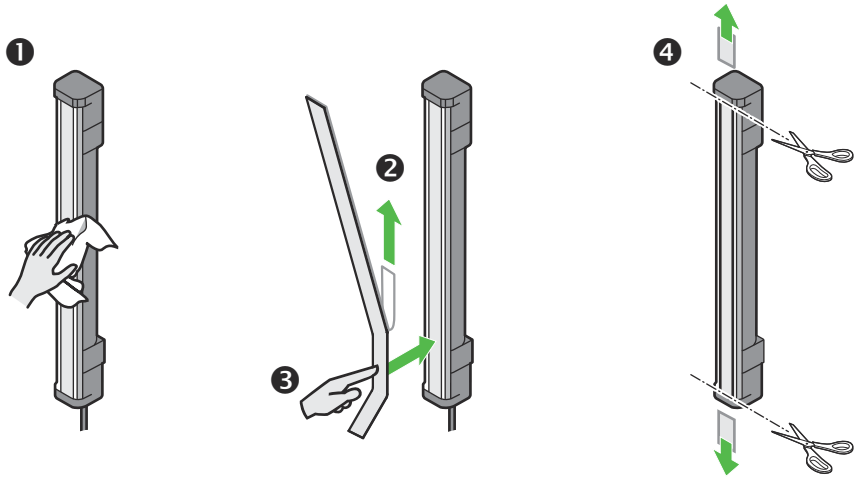



*Figure 70: Mount the weld spark guard*

1. Clean the front screen
2. Remove backing film
3. Press against the weld spark guard
4. Cut off excess ends

### Further topics

- "Minimum distance to reflective surfaces", page 31

## 15.4 Connectors

*Table 72: Ordering information for M12 connecting cable, 5-pin (0.34 mm²)* [9]

| Part | Type code | Part number |
|---|---|---|
| Female connector, straight, 2 m cable, flying leads | YF2A15-020UB5XLEAX | 2095617 |
| Female connector, straight, 5 m cable, flying leads | YF2A15-050UB5XLEAX | 2095618 |
| Female connector, straight, 10 m cable, flying leads | YF2A15-100UB5XLEAX | 2095619 |
| Female connector, straight, 15 m cable, flying leads | YF2A15-150UB5XLEAX | 2095620 |
| Female connector, straight, 20 m cable, flying leads | YF2A15-200UB5XLEAX | 2095614 |
| Female connector, straight, 30 m cable, flying leads | YF2A15-300UB5XLEAX | 2095621 |
| Female connector, angled, 2 m cable, flying leads | YG2A15-020UB5XLEAX | 2095772 |
| Female connector, angled, 5 m cable, flying leads | YG2A15-050UB5XLEAX | 2095773 |
| Female connector, angled, 10 m cable, flying leads | YG2A15-100UB5XLEAX | 2095774 |

9) Ambient operating temperature: Down to –30° C with fixed installation.

*Table 73: Ordering information for M12 connecting cable, 8-pin (0.25 mm²) [9]*

| Part | Type code | Part number |
|---|---|---|
| Female connector, straight, 2 m cable, flying leads | YF2A18-020UA5XLEAX | 2095652 |
| Female connector, straight, 2.5 m cable, flying leads | YF2A18-025UA5XLEAX | 2099229 |
| Female connector, straight, 5 m cable, flying leads | YF2A18-050UA5XLEAX | 2095653 |
| Female connector, straight, 7.5 m cable, flying leads | YF2A18-075UA5XLEAX | 2099230 |
| Female connector, straight, 10 m cable, flying leads | YF2A18-100UA5XLEAX | 2095654 |
| Female connector, straight, 15 m cable, flying leads | YF2A18-150UA5XLEAX | 2095679 |
| Female connector, straight, 20 m cable, flying leads | YF2A18-200UA5XLEAX | 2095680 |
| Female connector, straight, 30 m cable, flying leads | YF2A18-300UA5XLEAX | 2095681 |
| Female connector, angled, 2 m cable, flying leads | YG2A18-020UA5XLEAX | 2095779 |
| Female connector, angled, 5 m cable, flying leads | YG2A18-050UA5XLEAX | 2095780 |
| Female connector, angled, 10 m cable, flying leads | YG2A18-100UA5XLEAX | 2095781 |

*Table 74: Ordering information for M12 connection cable, 5-pin (0.34 mm²) [9]*

| Part | Type code | Part number |
|---|---|---|
| Female connector, straight, 0.6 m cable, male connector, straight | YF2A15-C60UB5M2A15 | 2096006 |
| Female connector, straight, 1 m cable, male connector, straight | YF2A15-010UB5M2A15 | 2096007 |
| Female connector, straight, 2 m cable, male connector, straight | YF2A15-020UB5M2A15 | 2096009 |
| Female connector, straight, 5 m cable, male connector, straight | YF2A15-050UB5M2A15 | 2096010 |
| Female connector, straight, 10 m cable, male connector, straight | YF2A15-100UB5M2A15 | 2096011 |
| Female connector, straight, 15 m cable, male connector, straight | YF2A15-150UB5M2A15 | 2096171 |

*Table 75: Ordering information for M12 connection cable, 8-pin (0.25 mm²) [9]*

| Part | Type code | Part number |
|---|---|---|
| Female connector, straight, 0.6 m cable, straight male connector | YF2A18-C60UA5M2A18 | 2096031 |
| Female connector, straight, 1 m cable, straight male connector | YF2A18-010UA5M2A18 | 2096032 |
| Female connector, straight, 20 m cable, straight male connector | YF2A18-020UA5M2A18 | 2096033 |
| Female connector, straight, 1 m cable, straight male connector | YF2A18-050UA5M2A18 | 2096034 |
| Female connector, straight, 10 m cable, straight male connector | YF2A18-100UA5M2A18 | 2096035 |

9) Ambient operating temperature: Down to −30° C with fixed installation.

| Part | Type code | Part number |
|---|---|---|
| Female connector, straight, 15 m cable, straight male connector | YF2A18-150UA5M2A18 | 2104374 |

*Table 76: Ordering information for connection cable (replacement of C4000 with deTec4)* [10)]

| Part | Type codes | Part number |
|---|---|---|
| M12 connection cable, 5-pin to M12, 5-pin | YF2A14-C20UB3M2A14 | 2096013 |
| Connection cable, M12, 8-pin to M12, 8-pin | DSL-6108GM25034KM1 | 2034865 |
| Connection cable M12 8-pin to M26, 7-pin | DSL-6130GM25034KM1 | 2081443 |
| Connection cable M12 8-pin to M26, 12-pin | DSL-6129GM25034KM1 | 2081442 |
| Connection cable M12 8-pin to M26, 12-pin | DSL-6129GM25034KM7 | 2112706 |

*Table 77: Ordering information for distributor*

| Part | Type code | Part number |
|---|---|---|
| T distributor, 5-pin | DSC-1205T000025KM0 | 6030664 |
| T distributor, 8-pin | DSC-1208T000025KM0 | 6058647 |
| T-connector with pushbutton for laser alignment aid, M12, 5-pin | | 2077933 |

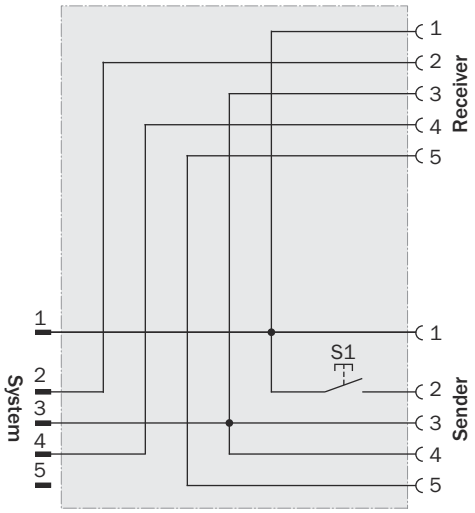



*Figure 71: Internal circuitry: T-connector with pushbutton for laser alignment aid (5-pin)*

*Table 78: Ordering information for the connector*

| Part | Part number |
|---|---|
| Muting connector | 2092758 |
| IO-Link connector | 2092757 |

*Table 79: Connection modules ordering information*

| Part | Part number |
|---|---|
| SiLink2 master | 1061790 |

*Table 80: Sensor Integration Gateway ordering information*

| Part | Part number |
|---|---|
| SIG200 REST-API | 1102605 |
| SIG200 PROFINET | 1089794 |
| SIG200 Ethernet/IP | 1089796 |

10) Ambient operating temperature: Down to −30° C with fixed installation.

*Table 81: Protective cap ordering information*

| Part | Part number |
|---|---|
| Protective cap, M12 for female connector | 5310772 |

*Table 82: Ordering information for power supply*

| Part | Type code | Part number |
|---|---|---|
| Output 24 V DC, 50 W (2.1 A), voltage supply NEC Class 2, SELV, PELV, input 120 V AC ... 240 V AC | PS50WE24V | 7028789 |
| Output 24 V DC, 95 W (3.9 A), voltage supply NEC Class 2, SELV, PELV, input 100 V AC ... 120 V / 220 V AC ... 240 V AC | PS95WE24V | 7028790 |

*Table 83: Ordering information for reset pushbutton*

| Part | Type code | Part number |
|---|---|---|
| Reset pushbutton, M12, 5-pin [1] | ER12-SB3C5 | 6045316 |

1) Suitable for resetting or for override applications.

*Table 84: Ordering information for pushbutton*

| Part | Part number |
|---|---|
| Pushbutton for laser alignment aid, M12, 5-pin | 2082166 |
| Pushbutton for laser alignment aid, M12, 8-pin | 2082167 |

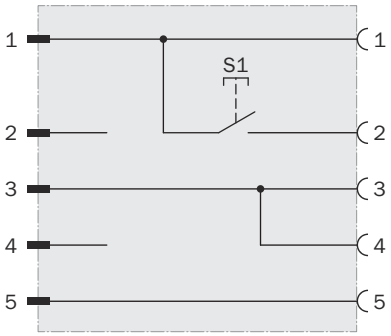



*Figure 72: Internal circuitry: pushbutton for laser alignment aid (5-pin)*

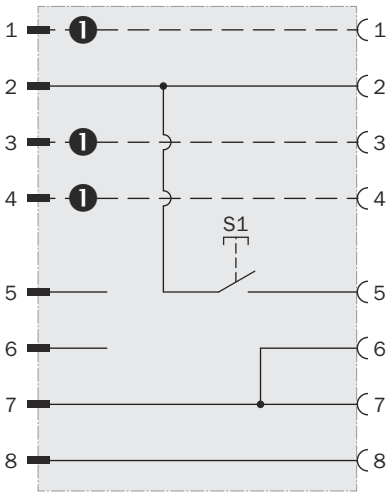



*Figure 73: Internal circuitry: pushbutton for laser alignment aid (8-pin)*

① Unused. The connection is not required but may be present.

## 15.5 Alignment aid

*Table 85: Alignment aid ordering information*

| Part | Part number |
|---|---|
| AR60 laser alignment aid | 1015741 |
| Adapter | 4070854 |

## 15.6 Deflector mirrors

### 15.6.1 Function and use

#### Overview

Deflector mirrors can be used to shape the protective field to secure hazardous points from multiple sides using a single safety light curtain.

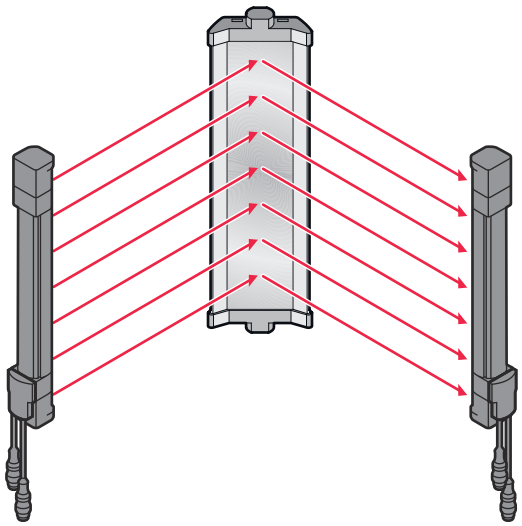


*Figure 74: Example of use of deflector mirrors*

#### Important information

**DANGER**
Hazard due to lack of effectiveness of the protective device

Persons and parts of the body to be protected may not be recognized in case of non-observance.

- ► Only mount deflector mirrors to solid walls or machine components. The position of the deflector mirrors must not change after alignment.
- ► Do not use deflector mirrors if contamination, beading water, condensation, or frost on the deflector mirrors is to be expected.
- ► Make sure that the deflector mirrors are intact and free of scratches, contamination, beading water, condensation, frost, etc. at all times.

#### Further topics

- "Mirror columns", page 162

### 15.6.2 Mounting

To mount the deflector mirrors, use the included swivel mount brackets.

### 15.6.3 Change in scanning range using deflector mirrors

#### Important information

**NOTE**
The use of deflector mirrors reduces the scanning range depending on the number of deflector mirrors in the protective field.

*Table 86: Scanning range with and without 1 or 2 deflector mirrors*

| Type | Solution | Scanning range, typical | Scanning range with 1 deflector mirror, typical | Scanning range with 2 deflector mirrors, typical |
|---|---|---|---|---|
| PNS75, PNS125 | 14 mm | 20 m | D1 + D2 ≤ 18 m | D1 + D2 + D3 ≤ 16.2 m |
| PNS75, PNS125 | 30 mm | 30 m | D1 + D2 ≤ 27 m | D1 + D2 + D3 ≤ 24.3 m |

#### Example: Recommended distance when using deflector mirrors

This example assumes a 90° beam deflection per mirror, and a protective field height of 900 mm.

When using a PNS75 deflector mirror, a distance of $D_1$, $D_2$, $D_3$ ≤ 4 m between the deflector mirror and the device, or between 2 mirrors is recommended.

When using a PNS125 deflector mirror, a distance of $D_1$, $D_2$, $D_3$ ≤ 8 m between the deflector mirror and the device, or between 2 mirrors is recommended.

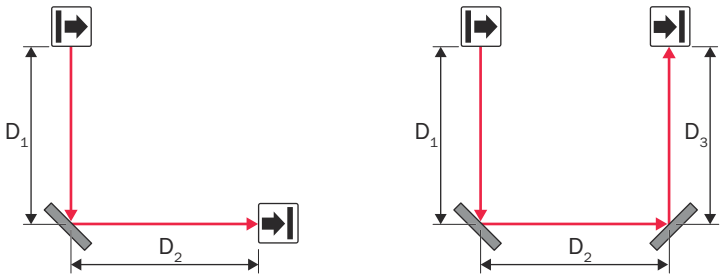



*Figure 75: Recommended distance when using deflector mirrors*

### 15.6.4 Deflector mirror PNS75 - ordering information

*Table 87: Ordering information for PNS75 deflector mirror*

| Mirror length in mm | Max. protective field height in mm | Type code | Part number |
|---|---|---|---|
| 340 | 300 | PNS75-034 | 1019414 |
| 490 | 450 | PNS75-049 | 1019415 |
| 640 | 600 | PNS75-064 | 1019416 |
| 790 | 750 | PNS75-079 | 1019417 |
| 940 | 900 | PNS75-094 | 1019418 |
| 1090 | 1050 | PNS75-109 | 1019419 |
| 1240 | 1200 | PNS75-124 | 1019420 |
| 1390 | 1350 | PNS75-139 | 1019421 |
| 1540 | 1500 | PNS75-154 | 1019422 |
| 1690 | 1650 | PNS75-169 | 1019423 |
| 1840 | 1800 | PNS75-184 | 1019424 |
| 1990 | 1950 | PNS75-199 | 1092962 |
| 2140 | 2100 | PNS75-214 | 1092963 |

### 15.6.5 Deflector mirror PNS125 - ordering information

*Table 88: Ordering information, deflector mirror PNS125*

| Mirror length in mm | Max. protective field height in mm | Type code | Part number |
|---|---|---|---|
| 340 | 300 | PNS125-034 | 1019425 |
| 490 | 450 | PNS125-049 | 1019426 |
| 640 | 600 | PNS125-064 | 1019427 |
| 790 | 750 | PNS125-079 | 1019428 |
| 940 | 900 | PNS125-094 | 1019429 |
| 1090 | 1050 | PNS125-109 | 1019430 |
| 1240 | 1200 | PNS125-124 | 1019431 |
| 1390 | 1350 | PNS125-139 | 1019432 |
| 1540 | 1500 | PNS125-154 | 1019433 |
| 1690 | 1650 | PNS125-169 | 1019434 |
| 1840 | 1800 | PNS125-184 | 1019435 |
| 1990 | 1950 | PNS125-199 | 1092964 |
| 2140 | 2100 | PNS125-214 | 1092965 |

## 15.7 Mirror columns

*Table 89: Ordering information, mirror columns*

| Column height | Mirror length | Type code | Part number |
|---|---|---|---|
| 1,281.5 mm | 1,082 mm | PM3C13-00030000 | 1043453 |
| 1,569 mm | 1,382 mm | PM3C15-00030000 | 1077525 |
| 1,716.5 mm | 1,532 mm | PM3C17-00030000 | 1043454 |
| 2,016.5 mm | 1,682 mm | PM3C19-00030000 | 1043455 |
| 2,216.5 mm | 1,832 mm | PM3C20-00030000 | 1043456 |
| 2,269 mm | 1,985 mm | PM3C22-00030000 | 1093216 |
| 2,419 mm | 2,132 mm | PM3C24-00030000 | 1093217 |

#### Complementary information

Observe the information on deflector mirrors, particularly on changing the scanning range.

#### Further topics

- "Deflector mirrors", page 160

## 15.8 Device columns

*Table 90: Ordering information for device columns*

| Column height | Max. installation length | Type code | Part number |
|---|---|---|---|
| 985 mm | 965 mm | PU3H96-00000000 | 2045490 |
| 1185 mm | 1165 mm | PU3H11-00000000 | 2045641 |
| 1285 mm | 1265 mm | PU3H13-00000000 | 2045642 |
| 1570 mm | 1550 mm | PU3H15-00000000 | 2068813 |
| 1740 mm | 1720 mm | PU3H17-00000000 | 2045643 |

| Column height | Max. installation length | Type code | Part number |
|---|---|---|---|
| 2040 mm | 2020 mm | PU3H21-00000000 | 2045644 |
| 2270 mm | 2250 mm | PU3H22-00000000 | 2045645 |
| 2420 mm | 2400 mm | PU3H24-00000000 | 2045646 |

## 15.9 Cleaning agent

*Table 91: Cleaning agent ordering information*

| Part | Part number |
|---|---|
| Anti-static plastic cleaner | 5600006 |
| Lens cloth | 4003353 |

## 15.10 Test rods

*Table 92: Ordering information, test rods*

| Part | Part number |
|---|---|
| Test rod 14 mm | 2022599 |
| Test rod 30 mm | 2022602 |
| Test rod holder | 2052249 |

*Table 93: Ordering information for the test rods with reduced resolution*

| Part | Part number |
|---|---|
| Test rod 24 mm | 2045592 |
| Test rod 34 mm | 2045593 |

## 15.11 Muting accessories

*Table 94: Ordering data of muting lamp*

| Part | Part number |
|---|---|
| Muting indicator lamp, including M12 male connector and connection cable (2 m), mounting bracket and mounting kit | 2033118 |
| Muting indicator lamp, including M12 male connector and connection cable (10 m), mounting bracket and mounting kit | 2033119 |

*Table 95: Ordering details – muting sensors and reflectors* [1)]

| Sensor | Type | Part number |
|---|---|---|
| Photoelectric retro-reflective sensor | GL6-P0211S49 | 1070568 |
| | GL10-P4151 | 1069860 |
| Photoelectric proximity sensor | GTB6-P7441S56 | 1077541 |
| | GTB10-P4411S01 | 1066852 |
| Reflector | P250 | 5304812 |

1) The specified muting sensors have been tested for the application and are therefore particularly recommended by SICK. A further selection of muting sensors are available at www.sick.com.

*Table 96: Ordering details – bracket for muting sensor and reflector*

| Part | Part number |
|---|---|
| Bracket for G6 muting sensor and P250 reflector | 2113145 |

*Table 97: Ordering data of muting arms*

| Part | Part number |
|---|---|
| Muting arm, short, 200 mm | 2111924 |
| Muting arm, long, 400 mm | 2111923 |

*Table 98: Ordering details – bracket for muting arms*

| Part | Part number |
|---|---|
| Muting arm bracket | 2106455 |
| Universal holder | 2044953 |

*Table 99: Ordering details – cable cover for muting arm*

| Part | Part number |
|---|---|
| Cable cover for muting arm, long, 400 mm | 2115890 |

## 15.12 Additional accessories

*Table 100: Information label ordering information*

| Part | Part number |
|---|---|
| Information label for reduced resolution [1] | 2101711 |

1) The information label cannot be used in applications with configured Smart Box Detection.

# 16 Annex

## 16.1 Conformities and certificates

You can obtain declarations of conformity, certificates, and the current operating instructions for the product at www.sick.com. To do so, enter the product part number in the search field (part number: see the entry in the “P/N” or “Ident. no.” field on the type label).

### 16.1.1 EU declaration of conformity

**Excerpt**

The undersigned, representing the manufacturer, herewith declares that the product is in conformity with the provisions of the following EU directive(s) (including all applicable amendments), and that the standards and/or technical specifications stated in the EU declaration of conformity have been used as a basis for this.

- ROHS DIRECTIVE 2011/65/EU
- MACHINERY DIRECTIVE 2006/42/EC
- RE DIRECTIVE 2014/53/EU

### 16.1.2 UK declaration of conformity

**Excerpt**

The undersigned, representing the following manufacturer herewith declares that this declaration of conformity is issued under the sole responsibility of the manufacturer. The product of this declaration is in conformity with the provisions of the following relevant UK Statutory Instruments (including all applicable amendments), and the respective standards and/or technical specifications have been used as a basis.

- Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012
- Supply of Machinery (Safety) Regulations 2008
- Radio Equipment Regulations 2017

## 16.2 Note on standards

Standards are specified in the information provided by SICK. The table shows regional standards with similar or identical contents. Not every standard applies to all products.

*Table 101: Note on standards*

| Standard | Standard (regional) |
|---|---|
| | China |
| IEC 60068-2-6 | GB/T 2423.10 |
| IEC 60068-2-27 | GB/T 2423.5 |
| IEC 60204-1 | GB/T 5226.1 |
| IEC 60529 | GB/T 4208 |
| IEC 60825-1 | GB 7247.1 |
| IEC 61131-2 | GB/T 15969.2 |
| IEC 61140 | GB/T 17045 |
| IEC 61496-1 | GB/T 19436.1 |
| IEC 61496-2 | GB/T 19436.2 |
| IEC 61496-3 | GB 19436.3 |
| IEC 61508 | GB/T 20438 |

| Standard | Standard (regional) |
|---|---|
| | China |
| IEC 62061 | GB 28526 |
| ISO 13849-1 | GB/T 16855.1 |
| ISO 13855 | GB/T 19876 |

## 16.3 Checklist for initial commissioning and commissioning

**Checklist for manufacturers or installers for installing electro-sensitive protective device (ESPE)**

The details relating to the items listed below must be available no later than when the system is commissioned for the first time. However, these depend on the specific application (the requirements of which must be reviewed by the manufacturer or installer).

This checklist should be retained and kept with the machine documentation to serve as reference during recurring tests.

This checklist does not replace the initial commissioning, nor the regular inspection by qualified safety personnel.

| | |
|---|---|
| Have the safety rules and regulations been observed in compliance with the directives and standards applicable to the machine? | Yes ☐ No ☐ |
| Are the applied directives and standards listed in the declaration of conformity? | Yes ☐ No ☐ |
| Does the protective device correspond to the required PL/SIL in accordance with EN ISO 13849-1 / EN 62061 and the required type in accordance with EN 61496-1? | Yes ☐ No ☐ |
| Is access to the hazardous area or hazardous point only possible through the protective field of the ESPE? | Yes ☐ No ☐ |
| Have appropriate measures been taken to protect (mechanical protection) or monitor (protective devices) any persons or objects in the hazardous area when protecting a hazardous area or hazardous point, and have these devices been secured or locked to prevent their removal? | Yes ☐ No ☐ |
| Are additional mechanical protective measures fitted and secured against manipulation which prevent reaching below, above or around the ESPE? | Yes ☐ No ☐ |
| Has the maximum shutdown and/or stopping time of the machine been measured, specified and documented (at the machine and/or in the machine documentation)? | Yes ☐ No ☐ |
| Has the ESPE been mounted such that the required minimum distance from the nearest hazardous point has been achieved? | Yes ☐ No ☐ |
| Are the ESPE devices properly mounted and secured against manipulation after adjustment? | Yes ☐ No ☐ |
| Are the required protective measures against electric shock in effect (protection class)? | Yes ☐ No ☐ |
| Is the control switch for resetting the protective devices (ESPE) or restarting the machine present and correctly installed? | Yes ☐ No ☐ |
| Are the outputs of the ESPE (OSSDs or safety outputs via the network) integrated according to the required PL/SIL in accordance with EN ISO 13849-1 / EN 62061 and does the integration correspond to the circuit diagrams? | Yes ☐ No ☐ |
| Has the protective function been checked in compliance with the test notes of this documentation? | Yes ☐ No ☐ |
| Are the specified protective functions effective at every operating mode that can be set? | Yes ☐ No ☐ |
| Are the switching elements activated by the ESPE, e.g. contactors, valves, monitored? | Yes ☐ No ☐ |
| Is the ESPE effective over the entire period of the dangerous state? | Yes ☐ No ☐ |
| Once initiated, will a dangerous state be stopped when switching the ESPE on or off and when changing the operating mode, or when switching to another protective device? | Yes ☐ No ☐ |

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